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EDITORIAL

Tapping Systems.

Systems of tapping rubber trees have passed through many phases, the controlling factors of which have been, firstly, the price of rubber and secondly, an appreciation of the effect of tapping on the health of the tree.

It is well known that in the earlier systems, a succession of cuts on the trunk of the tree was employed, resulting in the "herring bone" pattern of cuts. The system was abandoned as it was found that the consumption of bark was so rapid that insufficient time was allowed for bark renewal.

More conservative systems were therefore adopted which were designed to allow for as much tapping as was possible commensurate with the necessity of adequate bark renewal.

At that time the price of rubber dictated the heavy tapping which was universal in Malaya. The adverse effect of heavy tapping was the suspected cause of the well-known condition of the trunk of the tree known as brown bast, the occurrence of which frequently necessitated the removal of the affected tree and in any case, rendered a long resting period imperative.

But is was not until the advent of a slump in rubber prices which led to the Government restriction of exports that a revolutionary change was effected in tapping systems. The consequent curtailment in tapping resulted in more conservative systems being employed, such as smaller cuts, alternate day tapping and periodic tapping. Planters ultimately found that yields were rapidly re-established in spite of less frequent tapping, so that, on the abolition of compulsory restriction of exports, the new systems were generally retained. This increased yielding power of trees under conservative systems of tapping has proved a factor of considerable importance in reducing the costs of production during the present economic depression, when the price of rubber has fallen below the cost of production.

It will be seen, therefore, that whereas formerly the high price of rubber was a contributary cause of intensive tapping, which is expensive, the subsequent low price of rubber has led to more conservative methods in order to reduce costs of production.

Hitherto, no statistics have been available relating to the areas tapped under the different systems, so that the article which appears in this number, on "Rubber Tapping Systems on Estates" which covers all the tappable rubber on holdings of 100 acres and over in the Federated Malay States and Straits Settlements, provides the first reliable data on this subject.

It is shewn that 72.1 per cent. of the rubber is alternate day tapped, 20.6 per cent. on the A. B. C. System and only 7.3 per cent. is tapped daily.

It is significant that the Asiatic owned estates have not been slow to appreciate the advantage of alternate day tapping. Few, if any, of them have yet adopted the A. B. C. System, but the majority of them have changed over to the alternate day system.

Arrangements are now in hand to prepare statistics of the nationality of owners of estates over 100 acres each. It is thought that these figures will still further emphasise the fact that Asiatic owners of estates are becoming even more alert in adopting estate practices which lead to a conservation of their crop and the maintenance of their rubber trees in a good state of health.

No pronouncement can yet be made on the systems of tapping employed on holdings of under 100 acres each. Investigations on the bark consumption on small holdings are now in hand, but at least one year must elapse before any conclusion can be drawn from this work.

Improvement in Varieties of padi.

The method of improving yields of padi which provides the greatest opportunity of early results is by selection and cultivation of pure strains. In Malaya this work was first undertaken by the Department of Agriculture about 17 years ago and has given very material results. It is claimed that the yields of padi from the best selected strains are at least 25 per cent. higher than those of the original padi from which the strains were selected.

But there are definite limits to the improvement of yield obtainable by means of the isolation of selected strains and it is possible that we have now closely approached the maximum yield procurable by this method.

The possibility of further improvements by hybridization must therefore be explored. The article on "Hybridization of Selected Strains of Padi", which will be found in this number, is an account of the first steps taken in this direction. It demonstrates the difficulties which confront the investigator when attempting to cross-pollinate a cereal which naturally is self-pollinated. The perfection of the necessary technique is therefore of paramount importance, but it must be some time before any conclusions can be drawn from this work.

Liberian Coffee.

We have previously drawn attention in these pages to the opportunities that exist for coffee cultivation in Malaya. The annual importation of nearly 2 million dollars' worth

of coffee provides a starting point for encouraging a revival of this industry in Malaya.

The following article on "Liberian Coffee in Malaya" is designed to place before readers a statement of the position together with information on the methods employed in the cultivation and preparation of coffee. At a later date, it is proposed to supplement this information with an account of the investigations of the Department of Agriculture on this subject.

Palm Oil Machinery.

Previously, articles on palm oil machinery have been concerned with the systems actually employed on estates in Malaya, and on the technique of production. In this connection, the centrifugal and press systems have been the subjects of investigation. The article contributed to this number of the *Malayan Agricultural Journal* deals with the arrangement of machinery for the production of palm oil by the press system, and for the preparation of palm kernels. It must not be inferred, however, that the Department of Agriculture accepts responsibility for the information given in this article or advocates the adoption of any particular make of machinery.

Original Articles.

LIBERIAN COFFEE IN MALAYA

BY

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Introductory.

In a previous paper (1) information on the cultivation and preparation of coffee in Malaya was published. Since the appearance of this article the subject has received further attention with particular reference to the cultivation of Liberian coffee in Selangor at the present time. As is generally known, a considerable amount of interest was taken in the cultivation of Liberian coffee in Malaya during the years 1880—1898. In the Klang coffee district a large amount of British capital was invested, and estates were opened up in other districts of Selangor, Negri Sembilan and Pahang. Good profits were made in may instances until about 1898, when the price of coffee declined rapidly, due to increased production in Brazil. Interest then commenced in the planting of Hevea and the existing coffee areas rapidly became converted into rubber estates. During the present century the price of local Liberian coffee has fluctuated considerably, but for most of the period its cultivation appears to have been a paying proposition (2). The attraction of rubber, however, claimed almost entirely all agricultural enterprise. At the present time, the price of coffee, as with all tropical crops, is at a very low level.

The majority of the coffee plants grown in this country by Asiatics is Liberian, while several small estates devote their attention to Robusta. Much of this coffee is inter-planted with some other permanent form of cultivation, although certain areas are planted as a sole crop. Asiatic taste favours Liberian coffee, but a great deal of the coffee consumed is Robusta imported from Java. Owing to the very low price of coffee ruling at present and the demand for first class coffee only on the London market, the cultivation of Liberian coffee for export is undertaken only to a small extent. On the other hand, since the imports of coffee into Malaya are considerable, the production of locally grown coffee merits encouragement. The following table records figures obtained from official returns of the coffee trade in Malaya during 1930.

Table I.

Coffee Trade of Malaya in 1930.

	Raw		Tinned	
	Tons.	Value.	Pounds.	Value.
Imports	2,217	$2,612,890	636,480	$134,416
Exports	6,010	910,400	56,618	$162,593
Net Imports	3,793	$1,702,490	579,862	28,177

In Table II the official returns of acreage under coffee in Malaya at the end of the year 1930 are shown.

Table II.

Acrege under Coffee in Malaya at end of 1930.

Perak	...	583 acres.
Selangor	...	3,003 „
Negri Sembilan	...	665 „
Pahang	...	960 „
Total F.M.S.	...	5,211 acres.
Straits Settlements	...	867 acres.
Johore	...	3,200 „
Kedah	...	650 „
Total Malaya	...	9,928 acres.

Cultivation in Selangor.

In Selangor, most of the coffee grown is Liberian and this appears the most suitable species for the conditions obtaining in the coastal districts. The alluvial clay soils of the coastal districts, when adequatey drained, are admirably suited to the growth of Liberian coffee. This species also thrives on good loam soil inland, but has proved unsatisfactory on sandy soils or areas where "laterite" occurs. It is commonly stated that while Liberian bushes will live for 20—30 years on the coastal soils, the life of the bushes when planted in inland districts does not exceed 10 years.

Although Liberian coffee is usually planted at low elevations, excellent growth has been observed with bushes growing on a good loamy soil at Gunong Angsi, Negri Sembilan, at 1,000 feet elevation.

A number of Asiatic holdings have been visited in the Kuala Langat District of Selangor and the following information represents a summary of the methods practised.

Cultivation :—Seeds are sown about 6 inches apart in raised beds in a shady situation and watered when necessary. Germination commences within 6 to 8 weeks from sowing and is usually completed within a further period of one month. When the seedlings are 4 to 5 inches high and have 4 pairs of leaves, including the fish leaf, they are ready for transplanting. Under favourable conditions the seedlings are then 4 to 6 months old from germination. Experience has shown that, should the seedlings be allowed to remain longer in the nursery beds, permanent damage may result owing to the young plants developing a bent tap-root. The seedlings are planted 10 feet by 10 feet or 12 feet by 12 feet, square planting, that is 435 and 302 bushes per acre respectively. The wider spacing is preferable and should be adopted with the Liberian species.

Clean weeding is practised and on flat alluvial land is undoubtedly the most satisfactory form of cultivation. On sharply undulating land in the Sungei Balak Chinese Settlement, Cheras, Selangor, poor growth of bushes has been observed, due mainly to loss of soil fertility from erosion.

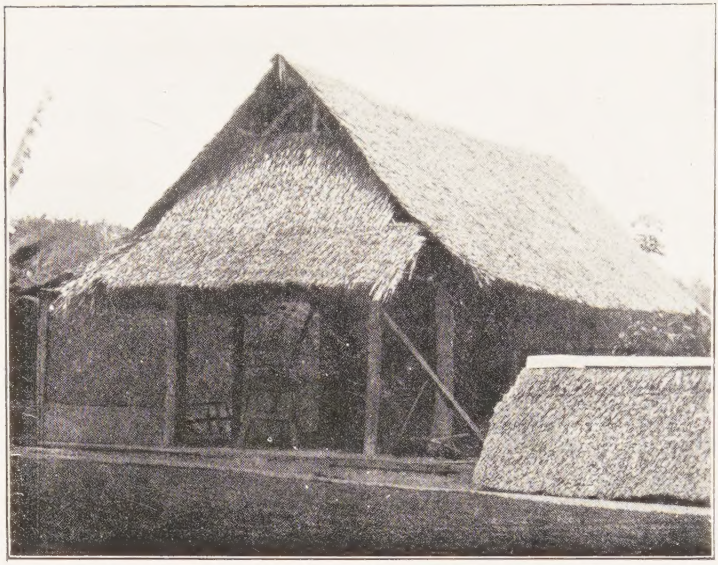
When grown as a sole crop no shade is provided; past and present experience justifies this procedure since the use of shade trees with Liberian coffee results in increased growth of foliage with a consequent reduction of flowering. Frequently, however, rubber or fruits trees are interplanted resulting in the bushes becoming heavily shaded and in course of time losing vigour. Pruning is attended to with some degree of skill. All bushes have a single stem demonstrating that attention is paid to suckering in the early stages of the plants' growth. The bushes are "topped" to within a height of about 6 feet, the cut being made through mature wood. Pruning is undertaken monthly and consists of the removal of all suckers, shoots from the apex of the stem, and those secondary branches which arise within one foot from the main stem.

Yields :—Under suitable conditions, the bushes commence flowering when two years old and a small crop is obtained during the third and fourth years, increasing with the age of the plant. Actual records of yield obtained by Chinese cultivators are difficult to obtain, but returns of 5 to 6 piculs (650—800 lbs.) of prepared beans per acre per annum appear to be obtained.

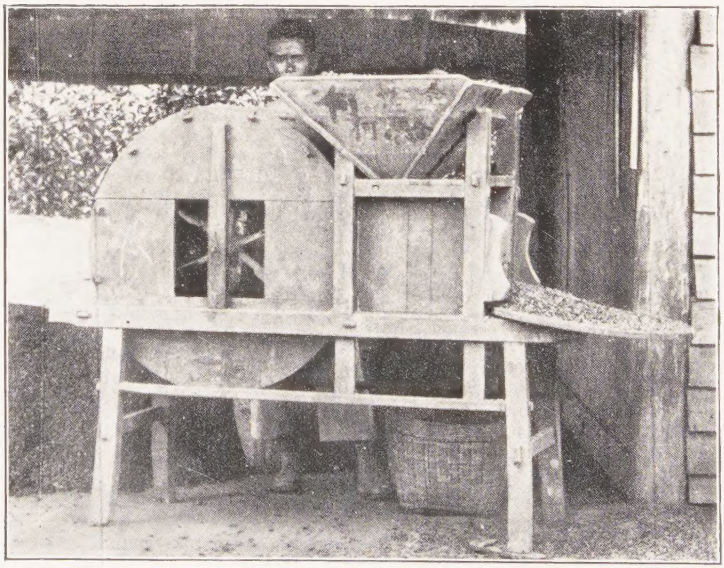
A number of articles were published in the Kew Bulletin during the period 1890—1895 regarding the production of Liberian coffee in the Malay States. Table III represents a summary of yields from several estates in Selangor and Negri Sembilan during the year 1891 (3).

LIBERIAN COFFEE, SHOWING FLOWERS AND BERRIES.

FOUR-YEAR OLD LIBERIAN COFFEE BUSH.



Coffee Store with Barbecue in foreground.



Winnowing Machine for separating Husks from Beans.

Table III.

Yield of prepared Coffee per acre for the year, 1891.

Estate.	Age of bushes (years.)	Area of fields acres.	Yield in Piculs.
Linsum Estate, Sungei Ujong. ...	11	62	7.97
Siliau Estate, Sungei Ujong. ...	10	36	7.45
Weld's Hill Estate, Selangor. ...	9½	65	6.90
Batu Estate, Selangor. ...	7	11¼	5.44

Yields from two estates in Sungei Ujong (Negri Sembilan) averaged 7 piculs of prepared coffee per acre per annum from three to four year old bushes. (1 picul = 133⅓ lbs.).

Manures.—Manuring consists of an annual application of rotted residue obtained during the preparation of the beans. The soil below the bushes is cultivated after the decayed husks are applied. The bushes, though in fair condition, would respond to systematic manuring.

Harvesting :—The two main cropping periods are May/July and December/February, but berries are collected throughout the year. During the principal fruiting seasons a labourer will pick about 20 gallons (or 130—140 lbs.) of cherry a day, which when prepared will yield about 20 lbs. of dry beans.

Preparation :—After plucking, the berries are placed to dry in the sun on an open clay barbecue for 6 to 7 days. During rainy weather a longer period is necessary. A portable dried palm leaf covering is employed at night and during rains. The heaps of berries are stirred three to four times daily to accelerate drying. The sun-dried berries are then collected and passed through a de-husker to remove the husk. The machines are made locally and consist of a hardwood or steel roller fitted with flanges so arranged as to exert pressure when rotated on the passing berries. This results in the partial removal of the dried pulp surrounding the beans. The intake is on the top of the de-husker and the husk and beans are discharged at the bottom. The rotating shaft is propelled by hand, usually four coolies being employed in manipulating the machine. Four hardwood blocks fitted on spokes are attached to each side of the shaft; this causes the roller to rotate at a regular speed. It is usually necessary to pass the dried berries three or four times through the de-husker before winnowing operations are undertaken. The winnowing machine is also made locally and is driven by hand. The husk and beans are separated by a strong draught of air produced by a rotating wooden fan. A device fitted below the intake controls the amount of husk and beans passing through the draught passage. It is frequently necessary to pass the beans through the de-husker again after winnowing. Subsequently the beans are sifted by hand several times over a bamboo hand-sieve with meshes about ⅓ inch wide.

The beans are then bagged and sold to Chinese dealers. The preparation takes, during suitable weather, 9 to 10 days. Four labourers are able to prepare about 65 lbs. of dried beans per day.

The samples of beans produced by the method outlined are irregular, of dark colour and frequently retain a large amount of silver-skin. Lack of controlled fermentation is a further source of poor quality. Samples of Liberian coffee de-pulped as fresh berries by machine and correctly fermented, produce roasted coffee of superior flavour to that obtained by the dry method practised by local Chinese. Undoubtedly coffee of higher quality might be produced if it were possible to induce the growers to employ the wet-method of preparation.*

Malay cultivators frequently sell fresh berries to Chinese who make a margin of profit on the cleaned beans.

Diseases and Pests:—Evidence of coffee rust or leaf disease (*Hemileia vastatrix*) is noticeable in all areas, specially where soil conditions are poor. It is difficult, however, to estimate the actual damage caused by this disease. Caterpillars of the bee-hawk moth (*Cephonodes hylas*) occur periodically. An area of some 500 acres of coffee in the Klang districts suffered serious defoliation owing to a severe attack of this caterpillar during 1930.

References.

1. Cultivation of Coffee in Malaya. *Malayan Agricultural Journal*, Vol. XVIII, page 481.
2. The Cultivation of Liberian Coffee. *Agricultural Bulletin F.M.S.* Vol. V, page 431.
3. Liberian Coffee in the Malay Native States. *Bulletin of Miscellaneous Information, Kew.* 1892, page 277.

* Described in the *Malayan Agricultural Journal*, Vol. XVIII, No. 10, October 1930.

RUBBER TAPPING SYSTEMS ON ESTATES

BY

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The following observations are based on the returns prepared by each rubber estate of 100 acres and over in the Federated Malay States and Straits Settlements of production, acreage tapped and rested and method of tapping for the month of July, 1931.

The Statistics Department receives these returns monthly from all estates possessing mature rubber. The number of such estates in July was 1,306, of which 108 estates, representing 55,975 acres (37,917 acres in the F.M.S. and 18,058 acres in the S.S.) had entirely ceased tapping, while a further total area of 132,785 acres was out of tapping on estates that had partly closed down.

Excluding the above, there remains a total of 767,788 acres of tappable rubber on areas of 100 acres and over in the F.M.S. and S.S. The following figures relate to 744,760 acres or 97 per cent. of this area, the balance of 3 per cent. being represented by incomplete information supplied on the subject of tapping methods.

Table I.

Area under different systems of tapping in the F.M.S. and S.S.

Estates of 100 acres or more.

State or Territory.	Alternate Daily Tapping	Daily Tapping	A.B.C. Systems		
			Tapped	Rested	Total A.B.C. Systems
	Acres.	Acres.	Acres.	Acres.	Acres.
Perak ...	134,872	14,532	35,347	12,221	47,568
Selangor ...	165,961	9,351	34,672	18,329	53,001
Negri Sembilan ...	131,882	11,349	16,972	5,406	22,378
Pahang ...	17,745	4,693	1,974	644	2,618
Total F.M.S. ...	450,460	39,925	88,965	36,600	125,565
Province Wellesley ...	15,734	2,649	2,938	5,319	8,257
Dindings ...	3,397	625	465	72	537
Penang ...	70	351	—	—	—
Malacca ...	48,490	14,677	13,341	5,450	18,791
Singapore ...	8,680	6,552	—	—	—
Total S.S. ...	76,371	24,854	16,744	10,841	27,585

Table II.

Area under different systems of tapping in the F.M.S. and S.S.

(expressed as percentages.)

State or Territory.	Alternate Day Tapping	Daily Tapping	A.B.C. Systems		
			Tapped	Rested	Total A.B.C. Systems
	per cent.	per cent.	per cent.	per cent.	per cent.
Perak ...	68.6	7.3	17.9	6.2	24.1
Selangor ...	72.7	4.1	15.2	8.0	23.2
Negri Sembilan ...	79.6	6.9	10.2	3.3	13.5
Pahang ...	70.8	18.7	7.9	2.6	10.5
Total F.M.S. ...	73.1	6.5	14.4	6.0	20.4
Province Wellesley ...	59.2	9.9	11.0	19.9	30.9
Dindings ...	74.5	13.7	10.2	1.6	11.8
Penang ...	16.6	83.4	—	—	—
Malacca ...	59.2	17.9	16.3	6.6	22.9
Singapore ...	56.9	43.1	—	—	—
Total S.S. ...	59.3	19.3	13.0	8.4	21.4
Total F.M.S. & S.S.	72.1	7.3	14.2	6.4	20.6

Tapping systems fall naturally into three categories: daily tapping, alternate daily tapping and rotational or periodic tapping—generally designated the A.B.C. system.

From reference to the accompanying Tables 1 and 2, it will be seen that during recent years the systems of tapping on Malayan estates have almost entirely changed from daily tapping to the more conservative method of alternate day tapping, while the tendency is for the adoption of the still more conservative method of rotational or periodic tapping. The figures show that at present 72.1 per cent. of this rubber is tapped alternate daily, 20.6 per cent. on rotational systems and only 7.3 per cent. daily. The daily tapping system is more common in the Straits Settlements than in the Federated Malay States. This is accounted for by the fact that in the Colony there is a larger proportion of estates owned by Chinese and other Asiatics than is the case in the Federated Malay States, and although it is observed that a number of Asiatic estates have adopted the alternate day system, the change-over from daily tapping is more protracted on Asiatic owned estates than on those owned or controlled by other nationalities.

Daily Tapping.—No case was found of daily tapping being performed over any large area with more than a single cut. The length of cut also tends to be short, so that there is doubtless ample time for bark renewal. The following percentages of the total area tapped daily shew that the more usual length of cut is $\frac{1}{3}$ or $\frac{1}{4}$ of the circumference of the tree :

1 cut $\frac{1}{3}$ circumference of tree	...	42 per cent.
1 cut $\frac{1}{4}$ circumference of tree	...	36 per cent.
1 cut $\frac{1}{2}$ circumference of tree	...	9 per cent.
1 cut "V" on half circumference of tree	...	1 per cent.
1 cut mixed $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{2}$, "V" etc,	...	12 per cent.

Alternate day tapping.—The most popular systems of alternate day tapping are a "V" on half the circumference of the tree, and a single cut on half the circumference of the tree. The first-named system accounts for 41 per cent. of the alternate-day tapped rubber, but this includes slight variations of the system, such as length of cut and the cutting of the right half "V" on one day, followed by the left half "V" on the following day. The single half cut is used on 24 per cent. of the areas under alternate daily tapping, while a mixture of methods is responsible for a further 15 per cent.

There remains, therefore, 20 per cent. of alternate day tapped trees which are accounted for by a number of methods such as single cut on $\frac{1}{3}$ circumference, 5 per cent : $\frac{1}{2}$ and $\frac{1}{3}$ basal "V", 2 per cent : $\frac{1}{2}$ spiral, which is particularly popular in Negri Sembilan, 5 per cent : and 2 cuts "V" on $\frac{1}{2}$ the tree, 1 per cent.

Rotational, Periodic or A.B.C. Systems.—Under this system the estate is divided into blocks which in rotation are allowed a resting period. Reference to Table I shews that of the area at present under this system in the F.M.S. and S.S. 69 per cent. is being tapped while 31 per cent. is being rested.

The actual systems employed are so numerous and varied that it is not possible at the present time to prepare any figures as to the relative areas of land under each variation. This rather points to the fact that although the system of resting each block of land has been known and practised in Malaya for some time, the relative merits of the manner of effecting this are still in an experimental stage, so that no general or settled policy for estates has yet developed therefrom. It is significant of the ultra conservative policy adopted on most estates that 86 per cent. of rubber tapped under "A.B.C. Systems" is tapped alternate daily, while there appears to be a preference for a "V" cut. The tendency therefore is for the adoption of a scheme somewhat of the nature of a 4 months rest in 12 months, trees being tapped alternate daily on a "V" over half the circumference of the tree.

The area of rubber covered by the present discussion of tapping methods amounts to 62 per cent. of the total in the F.M.S. and S.S., the remaining 38 per cent. consisting of holdings of under 100 acres each. Statistics are not

available regarding tapping methods employed on such holdings, but it is certain that the amount of bark removed and the frequency of tapping is on a more liberal scale than is now customary on the larger estates.

The adoption of present day methods of tapping has no doubt been brought about very largely by the necessity for curtailing crops during the period when production was restricted by law, but it was early discovered that, although yields declined on the adoption of such methods of tapping, the trees quickly regained their yields, and at the present time the average yield of rubber per acre on large estates is higher than formerly and tends still further to improve.

There is little doubt that rubber trees on estates have now a big reserve of bark, that the health and yielding capacity is still further conserved by the present methods of tapping and that should the price of rubber justify the course, estates could, by the resumption of more drastic tapping methods, immediately increase yields for a limited period.

HYBRIDIZATION OF SELECTED STRAINS OF PADI

BY

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Introduction.

Observations regarding the behaviour of the padi flower in pollination were first made locally by Jack † in 1919 and many of those observations are confirmed in this paper.

In the 1927—28 padi season these experiments on hybridization with padi were commenced at the Padi Experiment Station, Titi Serong, Krian, and were mainly instrumental in establishing useful negative information under local climatic and padi growing conditions.

During the following season, a simple technique was developed for "crossing" which probably would have been successful but for the very severe infestation of padi by stem-borers (*Diatraea auricillia*, Dudg., *Schoenobius incertellus*, Walk., *Sesamia inferens*, Walk.,) which occurred in Krian and elsewhere and which affected a great many of the tillers in the breeding cage and thus reduced the material available for experiment. Also, where successful crossing had been accomplished and grains were developing, borer-affected stems withered before the grains had fully matured while they were still in the "milk" stage. Consequently, very few grains matured and many of those which did ripen were too weak to survive germination.

In 1929—30, however, with greater experience and somewhat better conditions, the technique was improved, and very moderate success was obtained.

In this season also, serious infestation by stem-borers was again experienced so that the health of the plants in the breeding cage was much affected and again abnormal conditions militated against success. The stem-borer infestations were helped by unfavourable growing conditions for the padi due to long spells of dry weather which greatly retarded padi planting operations.

Flowering.

With the varieties grown at Titi Serong Padi Experiment Station, flowering begins 3½ to 6½ months after sowing when the panicle of the young, almost colourless, flowers emerges from the sheathing leaves. The flowers rapidly gain

† Preliminary Report on Experiments with wet Rice in Krian by H. W. Jack—*Agricultural Bulletin F.M.S.* Vol. 7. 1919.

* A Preliminary Account of Three Rice Stem-Borers by H. T. Pagden Bulletin No. 1 Scientific Series, Dept. of Agriculture, S.S. and F.M.S., June, 1930.

colour, usually greenish, and the stalk continues to grow another 12 or 18 inches during the following fortnight.

The flowers mature from the top and open irregularly in succession, requiring 6—8 days for all to open, depending on weather conditions especially on sunshine.

By looking at a flower against the light, the position and outlines of the anthers can be distinguished in the lower quarter of the flower, and in the early morning of the day on which the flower will open fully the anthers may be seen to rise inside the still closed flowers, being pushed upwards by the elongation of the stamen filaments. This elongation of the filaments commences a couple of hours before the flower opens, which it does quickly, usually at about 11 a.m. and the stamens protrude to their full length. The palea and lemna continue to move apart for a few seconds till they make an angle with each other of about 30° when fully open.

Self-pollination is usual and occurs at or immediately after the opening of the flower. The stigmas usually protrude one on each side and the overhanging anthers shed pollen on them. The stamens eventually drop over and fall away and in 20—30 minutes the flower closes up again with the stigmas still protruding and commencing to wither.

Regularity and time of flowering is affected by the health of the plants, and by atmospheric conditions.

The daily period of opening of flowers from unhealthy plants is much extended and wet or dull weather generally retards the hour of opening.

The amount of natural cross-pollination must be non-existant or very small indeed with healthy plants and in fine weather. In adverse weather conditions dehiscence of the anthers is delayed and may lead to a small amount of natural cross-pollination.

Method of Crossing.

The following is the method now adopted at Titi Serong for cross-pollination.

A panicle is selected on the plant to be used as the female parent, preferably one which has just commenced flowering as shown by 5 or 6 opened flowers near its apex. In the cool of the evening before dark (about 5.30 p.m.) the selected panicle is deprived of all its spikelets except about 10 well-formed ones.

These are emasculated by drawing out the stamens with a delicately sprung forceps after snipping off the tops of the lemna and palea about $\frac{1}{4}$—$\frac{1}{3}$ of their length from the apex with a sharp fine scissors, cutting off a little more of the lemna than of the palea. It is wise to use a good lens while emasculating, and the emasculated flower should be carefully examined afterwards for pollen grains. The forceps should be thoroughly cleaned or sterilized after each operation.

If any of the anthers burst in the process of emasculation, the flower is cut away, but this rarely occurs when emasculation is done in the cool of the evening. Emasculation of the higher spikelets on the panicle should be done first.

The panicle is then enclosed in a fine butter-muslin bag suspended over the panicle and expanded by a simple wire frame. The following day, just before flowering time (which is between 10.15 a.m. and 11.30 a.m. with the maximum rather before 11 a.m.) a panicle of the plant to be used as the male parent is chosen, which bears flowers that are opening. This is cut off with a fairly long stalk, put in a test-tube of water and carried to the hybridization cage.

The bag enclosing the emasculated panicle is withdrawn; anthers from the male parent are burst over each emasculated flower causing them to shed pollen on to the stigmas. The panicle is then re-enclosed within the muslin bag.

Bagging.

A fine butter-muslin bag is used because protection is necessary for the cut flowers between emasculation and setting of grain and afterwards against Leptocorisa spp. and other insect pests. The bag is kept in position until the grain has passed the milk stage for this latter reason. The bag used is of muslin because of the excessive transpiration which causes the atmosphere within glacine paper bags to become so humid that the flowers rot, while with a butter buslin bag evaporation is possible.

Maturation of Grain.

Examination was carried out by dissection of ordinary self-pollinated flowers of Radin 2, at hourly intervals from 12 mid-day to 6 p.m. and from 6 a.m. for the first twenty-four hours, and then at daily intervals at 11 a.m.

Twenty-four hours after pollination the ovary of the flower of Radin 2 padi is 1 m.m. in length. There does not appear to be any change in size until after 21 hours when the commencement to enlarge is just perceptible. After

2 days the length of the developing rice grain is	1.25 m.m.
After 3 days the length of the developing rice grain is	2.50 m.m.
After 4 days the length of the developing rice grain is	4.00 to 4.50 m.m.
After 4 days the length of the developing rice grain is	6.00 to 6.50 m.m.
After 5 days the length of the developing rice grain is	7.00 m.m. and is just filling the husk.

After 6 days the husk is fully filled, but the rice is still in the "milk" stage, and takes about another 24 days to reach full ripeness.

Results to date.

As has already been stated, moderate success was obtained in the 1929—30 season. Over 100 grains were obtained from cross-pollinated flowers. Of

these only 25 germinated in August 1930; 16 grew to the seedling stage but only 10 developed fully.

Reciprocal crosses were made with Radin 2, Radin 4, Radin 7, Radin 13, Seraup Kechil 36, Seraup Kechil 48, F.S. 27, and Pahit 1, and pollen was used from two or three other varieties also. There were numerous failures to set grain, particularly at the beginning of the experiments and at the end of the season.

Below are details of certain specific cases in which alone grain set.

The fully formed kernal from a flower of which the tops of the lemna and palea had been cut off was constricted and attenuated above the point of exposure, but was quite normal in all other respects.

The following set grain after the pollination of 10 flowers in each case, but failed to germinate :—

R. 2 X	F. S. 27	F. S. 27 X	R. 2
	S. B. 48		R. 4
	S. K. 48		S. K. 48
	R. 7		F. S. 824
	F. S. 80		R. 7 (twice)
S. K. 48 X	R. 2		F. S. 44

Seeds from the following crosses germinated satisfactorily but failed to develop into mature plants.

R. 2 X	F. S. 27
	S. K. 36
S. K. 48 X	R. 4
F. S. 27 X	R. 7

Crosses R. 2 X F. 27 (8 plants) and R. 2 X S. 36 (2 plants) germinated and produced very robust mature first generation hybrid plants which gave an abundance of ripe F. 1. seed.

Additional Notes on Emasculation.

Emasculation was usually done in the evening as it was easier and more successful, but it was occasionally done in the morning before the flowers commenced opening.

With reference to emasculation in the morning, it might be mentioned that it was found easier to operate at about 9 a.m. than at 7 a.m. because it was safer to wait until the stamens had elongated somewhat so that the forceps could be inserted beneath the anthers without damaging the stigmas and at any time in the morning the anthers of mature flowers required more careful handling than on the previous evening.

It was found quite impracticable to emasculate before the panicle had properly emerged from its sheath, as the flowers were so delicate that it was almost impossible to avoid damaging them severely.

(i) The palea and lemna of nearly mature flowers were gently forced apart and the anthers removed with a fine scalpel or forceps. Emasculation was successfully done in this way, but it was tedious. Moreover, the rigidity of attachment of the palea to the base of the flower almost invariably resulted in the delicate brittle base of the flower being damaged, so that even in successful cases of cross pollination, when the flower set grain, the development of the grain would cease after a day or two because of the damage to the vascular system.

(ii) The tops of 10—20 flowers on a panicle were snipped off, other flowers being removed. The panicle was protected, and the elongation of the stamens awaited. When the stamens were fully elongated the anthers were exposed outside the flower and easily removed.

This was not so convenient a method as early emasculation, and furthermore, in fully 50 per cent. of the flowers at least one of the anthers shed pollen as it was being pushed out.

It will be noted that the female parent of all the successfully grown plants was Radin 2. It is a robust growing variety of early padi and is easier to emasculate than most others. By reason of its earliness it was able partially to avoid the peak of the stem-borer infestation.

Radin 2 is a favourite rice with most Malays for its eating qualities, and is a fairly heavy yielder.

The male parent F.S. 27 is a Nachin type of short maturation period. It is a good milling padi and has sturdy straw. The rice also is popular for eating.

The male parent S. K. 36 is the highest yielding of all of Jack's selected strains.* It is a late maturing variety of excellent milling grain.

The hybrid seeds were sown on 4.8.30, flowering commenced on 14.12.30, and grain ripened on 19.1.31 The average number of tillers was 40.

These plants were very similar to the female parent type in growth habits and in general appearance, but the grain showed distinct evidence of hybridity.

The F. 1 generation seed will be sown next July,and a further description of the experiments, including details omitted in this short account and with additional results, will follow in due course.

*Rice in Malaya, H. W. Jack. *Malayan Agricultural Journal, 1923.*

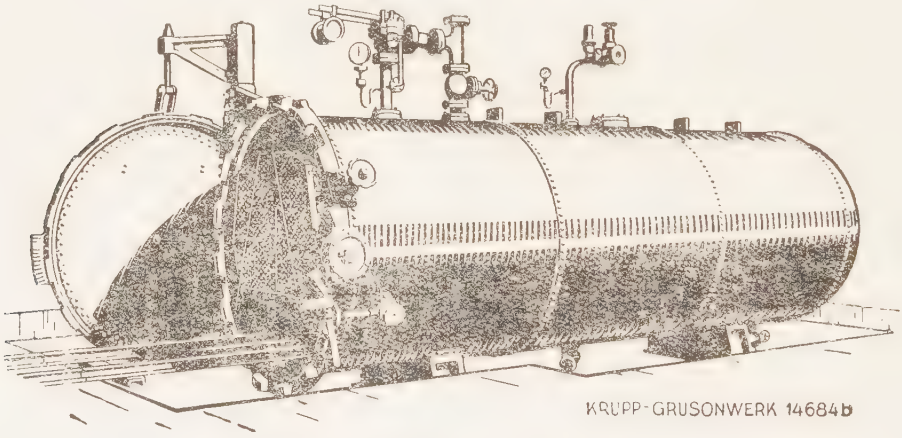
THE PRODUCTION OF PALM OIL ON A LARGE SCALE *

BY

R. SIEBERT,

Dipl. Eng. Memb. of V.D.I.

As there will be a considerable acreage of oil palms coming into bearing shortly and several grants of land have been made for planting oil palms on a large scale, the paramount problem facing the industry is how to reduce production costs and to increase the recovery of oil to the maximum. It might therefore be of interest to producers generally to have particulars in regard to a method of dealing with oil palm fruit on a large scale by a treatment which is known and usually called after one machine viz. "the swing press system".



HORIZONTAL STERILISER WITH VACUUM. (fig. 1)

The method of treatment described herein is characterised by an endeavour to bring down the cost of treatment to the smallest possible figure and at the same time produce an oil with a very low free fatty acid content. At present the premium obtained for oil of a low acidity is very small but in due course the superiority of such oils will no doubt be recognised.

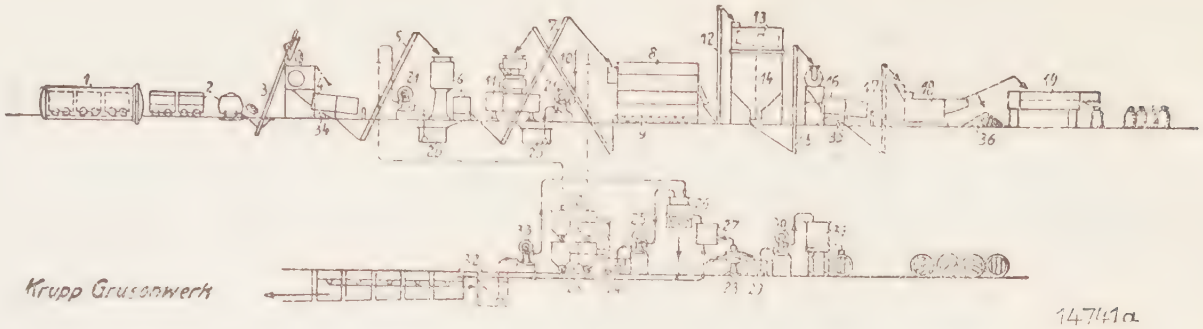
The machines used in this swing press system were devised as a result of more than 25 years' experience of palm oil machines and the method is, with slight variations to meet certain local conditions, in use in various parts of the world for the treatment of the output of about 150,000 acres of oil palms.

It should be mentioned that for an estate of under 1000 acres, single pressing would give the greatest economical advantage, whereas on larger estates the use of screw presses for a second pressing would shew the best results.

The working of such a plant following the scheme on page 536 would be as follows :—

* The following contributed article gives a concise account of an up-to-date factory for the preparation of palm oil and kernel on a large scale. It must not be inferred, however, that The Department of Agriculture accepts responsibility for the information or advocates the adoption of any particular make of machinery.

Main Points in connection with PALM OIL PLANTS capable of recovering up to 96% Oil.



A. Sterilization of fruit and seperation of same.

1. Horizontal sterilizer.
2. Containers for bunches
3. Inclined elevator.
4. Stripper with screening drum.

B. Production of Palm Oil.

5. Inclined bucket elevator.
6. Hydraulic fruit press with swing cage.
7. Inclined bucket elevator.
8. Continuous pulping and drying drum.
9. Worm conveyor for pulp fibres.
10. Inclined bucket elevator.
11. Automatic Oil Expeller with duplex heating kettle.

C. Production of Palm Kernels.

12. Bucket elevator.
13. Grading cylinder for nuts.
14. Silo for nuts.
15. Bucket elevator.
16. Centrifugal nut cracker with screening drum.
17. Bucket elevator.
18. Palm-kernel separator.
19. Dryer for palm kernels.

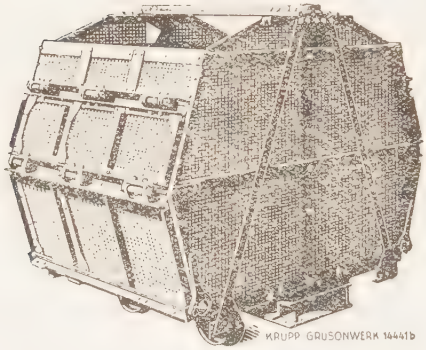
D. Purification of the Oil.

20. Crude-oil tanks.
21. Oil pumps for crude oil.
22. Oil purifier.
23. Oil and fruit-juice separator.
24. Tank for preliminarily-purified oil.
25. Oil Pump.
26. Steam-jacketed oil kettle.
27. Settling tank.
28. Centrifugal Oil purifier.
29. Oil tank.
30. Oil pump.
31. Draw-off oil tank.
32. Pit for recovering the residual oil from the fruitjuice and water.
33. Oil pump.

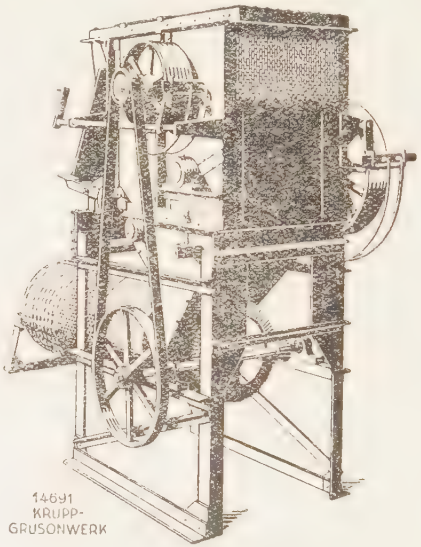
The figure numbers in the text refer both to the above "lay-out" of the machinery and to the illustrations that accompany this article.

A. Harvesting, Sterilising and Stripping of Fruits.

The selected ripe fruit bunches are harvested and collected in containers (fig. 2) and transported to the factory on a light railway. As these containers are designed to fit the sterilisers (fig. 1) the bunches, after having gone over the weigh bridge, pass without being unloaded direct into the sterilisers.



CAGE INTO WHICH THE BUNCHES ARE HARVESTED IN THE FIELDS AND IN WHICH THEY ARE STERILISED.
(fig. 2)

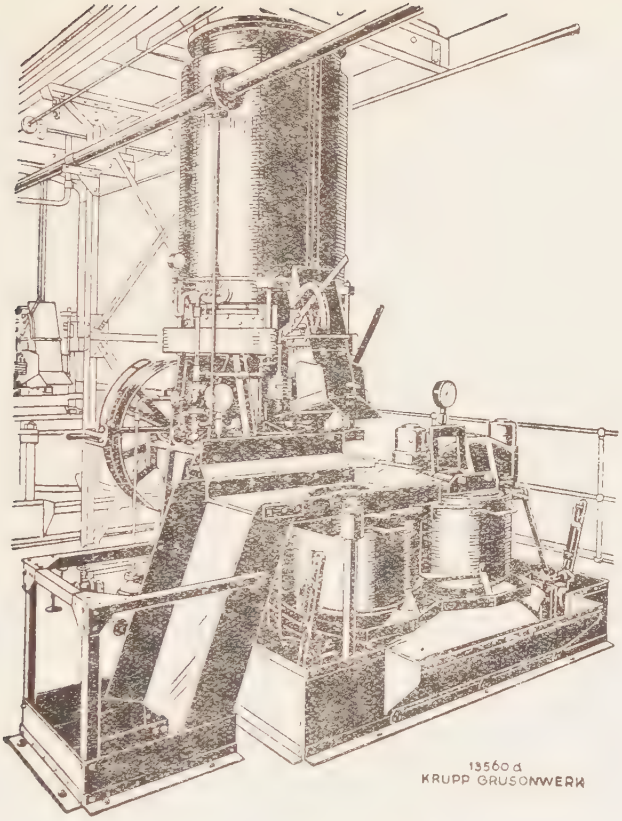


STRIPPER (B. PAT.) WITH SIMPLE DISCHARGE FOR TRUNKS BY MEANS OF LIFTING A FLAP.
(fig. 4)

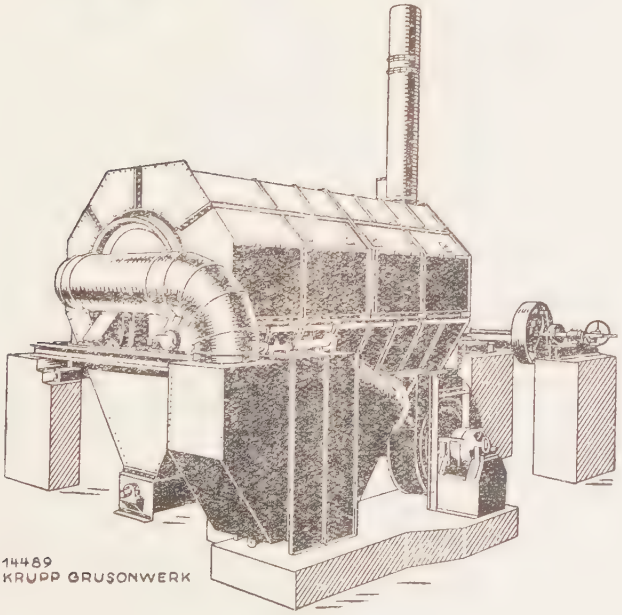
The destruction of the naturally occurring enzymes and the loosening of fruits is achieved by treating the bunches with live steam of low pressure. The bunches are then dried and deodorized by applying a vacuum. The rapid locking device at the back of the steriliser having been opened, the containers are withdrawn, the bunches discharged and lifted by an elevator (fig. 3) to the stripper (fig. 4.) This stripper being of a special patented design readily threshes the fruit from the bunches by means of revolving beaters. The trunks are discharged by lifting a flap and the small stalks and leaves are separated by a sieving drum.

B. Digesting and Pressing by Swing Cage Press and Expeller.

The palm fruit delivered by the stripper is lifted by the elevator (fig. 5) to the steam jacketed digester (fig. 6) (fruit boiler) to disintegrate the oil cells by heat and to form a pulp by the therein rotating agitator. Underneath the digester is the swing cage press (fig. 6) which consists of two cages, which are simultaneously first under low and then under high pressure. The press it attended to by one man only, gives an oil yield of more than 90 per cent. and has a capacity of between 1200--3000 pounds of fruit per hour, this depending upon the pressing time and the use of accumulators. A protecting box effectually restrains the oil from spraying about. The cake is now passed by means of an elevator (fig. 7) to a continuous working pulping and drying drum (fig. 8) in which the pulp is separated from the nuts under a current of hot air.

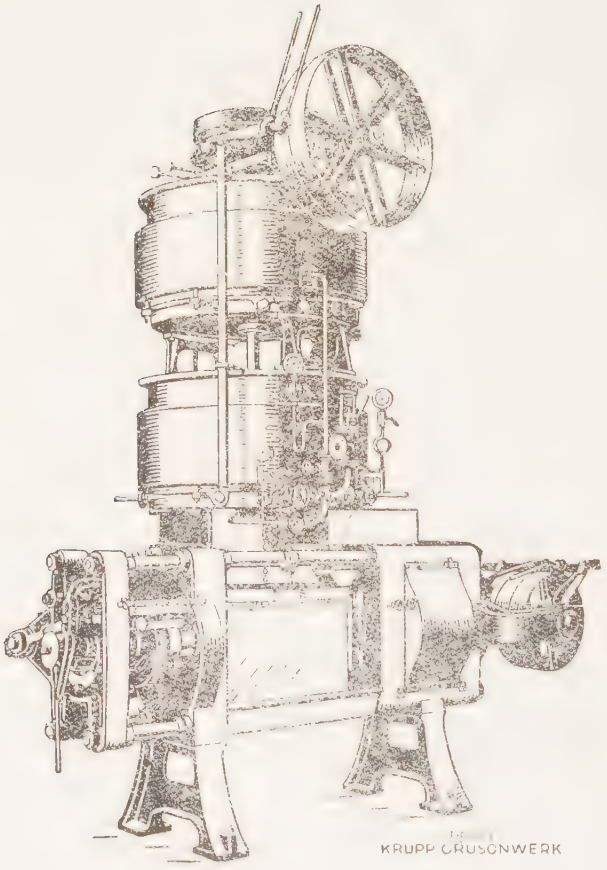


SWING CAGE PRESS.
(fig. 6)



DEPULPER AND DRYER FOR THE CAKE FROM THE SWING CAGE PRESS.
(fig. 8)

The dried separated pulp is then discharged into a screw conveyor (fig. 9) and lifted by an elevator (fig. 10) to a double heating kettle to be redigested. From this it passes direct to an expeller, (fig. 11) which by means of a screw, presses out the last drop of oil available. (When properly treated the oil content of the cake should amount to 9 per cent. only, calculated on dry residue).

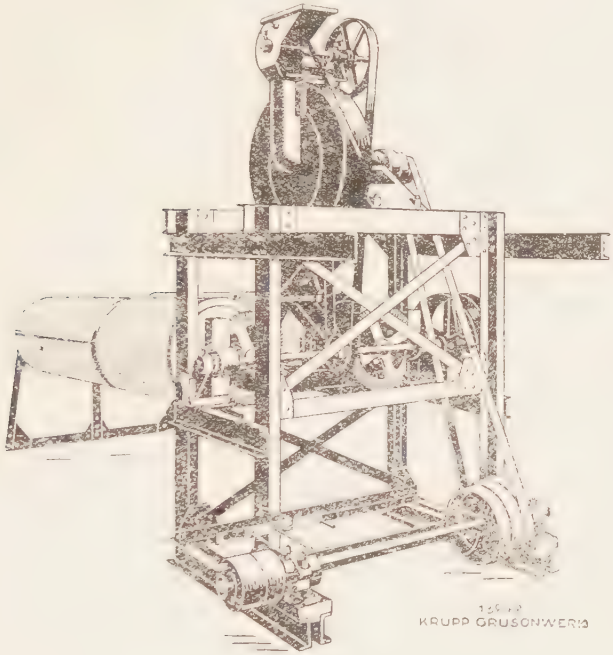


EXPELLER WITH DOUBLE HEATING KETTLE FOR EXTRACTING THE OIL FROM THE PULP.

(fig. 11)

C. Production of Palm Kernels.

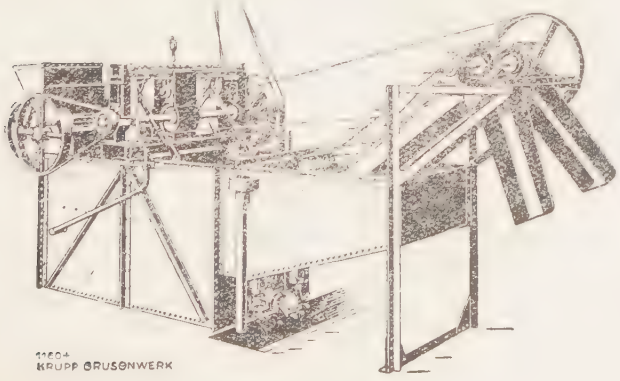
The clean and dry palm nuts discharged by the depulping drum are lifted by elevator (fig. 12) to a grading cylinder (fig. 13). Underneath this there is a silo consisting of two compartments, one for the larger and the other for the smaller nuts, which are by bucket elevator (fig. 15) fed separately to the cracker (fig. 16).



NUT CRACKER WITH SCREENING DRUM.

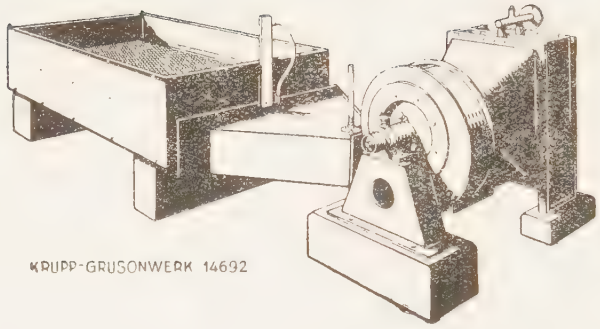
(fig. 16)

The kernels are separated from the small shells and the shells which are larger than the kernels by a sieving drum arranged under the cracker. The kernels and the shells of the same size are lifted by a bucket elevator (fig. 17) to the palm kernels separator, (fig. 18) which works without any addition of clay or salt on the jig prinaple. The kernels are dried on a kernels dryer (fig. 19) by heated air, and after cooling bagged for transport.



KERNEL SEPARATOR WITH JIGGING MOTION.

(fig. 18)



KERNEL DRYER. HOT AIR PROCESS.

(fig. 19)

D. Purification of the Oil.

The crude oil collected in the oil tanks (fig. 20) is pumped (fig. 21) to the oil purifiers (fig. 22) where it is led through water which has been heated by steam coils. The oil from the surface is drawn off by a tilting pipe to a tank (fig. 24) to be collected for further treatment in the steam packeted oil heating kettle (fig. 26). The miscellaneous coagulated matter, however, is with other impurities drawn off from the bottom into an oil and fruit juice separator (fig. 23), to be treated by water and steam, until such time as the last drop of oil is capable of being skimmed off into the collecting tank (fig. 24). From here the oil is pumped (fig. 25) to a steam-jacketed boiler (fig. 26) where the slimy ingredients are coagulated. The oil, after having settled in a settling tank, (fig. 27) is passed to the centrifugal cleaner (fig. 28). This centrifugal cleaner separates the last traces of water and impurities. Thus in a few hours the oil is ready for transport and is packed from a draw off tank (fig. 31) into barrels or pumped into tanks if shipment in bulk is required.

The fruit juice and all other liquids which come from the steriliser, various tanks and machines are collected for settlement in a pit (fig. 32) before being allowed to flow out of the factory. By this arrangement and by assaying the cake from the expellers the loss of oil for the whole plant is under control of the manager and the highest recovery possible is assured. This in favourable conditions (ripe fruit working on a large scale) should amount for *the whole plant* to more than 96 per cent.

Abstracts.

PREPARATION OF PINEAPPLE BRAN.

A note on pineapple bran which appeared on a previous number of this Journal has brought several enquiries concerning the machinery necessary and the cost of preparation.

Particulars of the machinery, as supplied to the Hawaiian canneries, have now been received from the makers in Colerado, whose address can be supplied on application to this Department.

The following figures are based on Hawaiian fruit and conditions.

The average sugar content in the juice is 10—12 per cent., the range being from 9—14 per cent., while the average fibre content in the waste is 4 per cent. (4—4.5 per cent.)

Although no description of the working of the plant is given, it would appear that the machinery consists essentially of a coarse shredder, a press, a fine shredder and a drier unit.

The waste is passed through a shredder which effects a coarse shredding. It is then pressed to extract as much as possible of the liquid. With single pressing only, the extraction in juice is about 25 per cent. on fruit or 50 per cent. on waste to be pressed, and 4.4 to 4.8 per cent. dry bran on fruit or 8.8. to 9.6 per cent. on waste from cannery.

Providing double pressing (first and second pressing) the juice extraction is 37.5 to 38 per cent. on fruit (75 to 76 per cent. on waste) and 3.3 to 3.5 per cent. bran on fruit or 6.6 to 7.0 per cent. on canning waste (66 to 70 lbs. of dry bran per ton fruit entering the cannery).

Single pressing requires less horse power but increased fuel for drying and gives the maximum bran yield. Double pressing requires more horse power but decreased fuel for drying and yields less bran.

1 ton of fruit gives 1,000 lbs. waste. The first pressing yields 500 lbs. juice leaving 500 lbs. waste of about 80 per cent. moisture. The second pressing gives a further 250 lbs. of juice leaving approximately 250 lbs. of waste of 76 per cent. moisture to be dried to 10 per cent. This on drying will give 66 lbs. of bran of 10 per cent. moisture or 3.3 per cent. on fruit processed.

The specifications shew that the pressed waste is passed by a conveyor to a Buittner type drier, but the length of time required for drying the bran is not stated.

It is stated, however, that if the cannery is very small, it may be advisable to hold the bran for one or two days and then to dry a two or three days' accumulation together if the temperature and humidity permit this and fermentation is not too rapid.

Specifications.

"For all machinery from shredder to sacking scroll of bran for a capacity of 6 tons of pineapple per hour and finished bran up to 600 lbs. per hour, including the complete plant except prime mover.

1. One No. 5 type C shredder A for coarse shredding of waste.
2. One feed hopper of chrome nickel steel.
3. One No. 0 pine waste press.
4. One No. 5 type C shredder B for fine shredding.
5. One elevator conveyor to convey pressed waste to drier.
6. One complete 3 feet 3 inches Buittner type drier unit consisting of drier with supporting and driving arrangements, spirale, housing, cyclone, fan, and complete furnace with fire brick.
7. One complete oil burning arrangement for furnace, consisting of burner, pump, heater, piping and storage tank.
8. One dry bran scroll and elevator and sacking scroll.
9. The complete shafting, bearing, pulleys, belting and hoppers, and chutes."

Any size of plant up to 50 tons of fruit hourly capacity can be supplied.

The Malayan factories are usually small, and it is possible that a plant up to 10 tons hourly capacity would be suitable in most cases. Two or three men would be required to operate such a plant.

The present cost of the plant detailed in the above specification is $20,600 (Gold) F.O.B. San Francisco, California, while the 12-ton hourly capacity plant is quoted at $26,400 (Gold).

The address of the makers of this machinery will be given on application to the Department of Agriculture, Kuala Lumpur, while those interested may have access to the letter from the makers which supplies information additional to the above. (Reference. D.A. 539/31).

THE MALAYAN RUBBER INDUSTRY IN 1930*

The following is a tabulated statement of the rubber statistics of Malaya contained in the Report :—

Area and Production of Rubber in Malaya, 1930.

State or Territory.	Area planted in 1930	Total area end of 1930	Production 1930 (tons.)		
			On estate over 100 acres	On small holdings	Total production.
Perak ...	6,273	525,707	44,617	—	—
Selangor ...	2,869	483,303	52,000	—	—
Negri Sembilan ...	5,829	337,018	38,432	—	—
Pahang ...	3,803	129,928	5,740	—	—
Total F.M.S. ...	18,774	1,475,956	140,789	110,206	250,995
Singapore ...	7	50,174	2,657	—	—
Penang ...	50	63,481	123	—	—
Province Wellesley ...	212	12,984	5,693	—	—
Malacca ...	1,060	198,888	14,827	—	—
Dindings ...	90	14,890	1,175	—	—
Total S.S. ...	1,419	340,417	24,475	38,770	63,245
Johore ...		705,298	42,758	—	—
Kedah ...	Figures	289,942	24,210	—	—
Kelantan ...	not	73,066	3,114	—	—
Trengganu ...	available.	47,991	1,333	—	—
Perlis ...		5,000	96	—	—
Total U.M.S. ...		1,121,297	71,511	66,113	137,624
Grand Total Malaya ...		2,937,670	236,775	215,089	451,864

For comparison the net export figures for the three previous years are given :—

		Rubber, tons.	Latex, Galls.
1927	...	188,456	1,560,976
1928	...	258,906	919,909
1929	...	415,608	1,708,529

Similar data for rubber for the Netherlands East Indies and for Ceylon are shewn below for comparison :—

		N. E. Indies tons.	Ceylon tons.
1928	...	226,000	56,000
1929	...	259,000	80,500
1930	...	170,000	75,000

* Abstract from the Annual Report of the Department of Agriculture, S.S. & F.M.S. for the year 1930 by H. A. Tempany, D.Sc., F.I.C., F.C.S., Director of Agriculture, S.S. & F.M.S.

During the year it was decided to suspend further alienation of land for rubber planting throughout Malaya and since September, 1930, no fresh alienations have been made, consequently additions to the planted areas so far as is known have since that date only occurred on land previously alienated.

Economic Conditions of the Rubber Industry.

The sale price of rubber during 1930 fell to the lowest figure in the history of the industry. The average Singapore price of first grade smoked sheet during the four quarters of the year was as under:

First quarter 25 cents per lb., Second quarter 22½ cents per lb., Third quarter 15½ cents per lb., Fourth quarter 13¼ cents per lb.

In an attempt to reduce stocks and so improve the price, a "tapping holiday" was agreed upon during the month of May. This was very generally observed by the owners of big estates (i.e., those of 100 acres or over), with the result that the crop harvested in the Federated Malay States in May on such estates was only 1,688 tons as compared with 11,137 tons harvested in April. The smaller holdings did not observe this holiday and it is agreed that its effect upon the sale price of rubber was negligible.

Later in the year official conversations between the Governor of the Netherlands East Indies and the High Commissioner for the Federated Malay States were arranged. During these the question of the possibility of imposing some form of restriction of output or export to be enforced by the Governments concerned was discussed. It was later announced that no official steps to restrict the export or production of rubber were contemplated.

Towards the end of the year a number of estates and of the poorer small holdings had ceased tapping wholly or in part, and it is estimated that at the end of the year the area out of tapping in the Federated Malay States and Straits Settlements, respectively, was as follows:

Federated Malay States	133,213 acres.
Straits Settlements	32,373 acres.

Conditions on Estates.

Throughout Malaya the larger estates on the whole maintained the normal standard of upkeep throughout the year, but especially during the later months some curtailment of fieldwork became inevitable as the result of the low price of rubber; staffs and labour forces were curtailed, salaries and labourers' wages were reduced, and tasks were increased with the sanction of the Labour Department, while a considerable number of Indian labourers had been repatriated up to the end of the year; so far as is known no estates had been abandoned, but a continuation of existing conditions must inevitably lead to the elimination of the weaker units.

Considerable economies in production have been effected and many estates have found it possible to reduce their f.o.b. cost of production to 10-12 cents per lb. Straits currency, a figure which, however, leaves little or no margin for profits and allows nothing for improvements.

Continued attention has been given by estates to the planting of high yielding clones of budded rubber. During the year importation of budwood from the Netherlands East Indies was continued, but the quantity imported was less than in 1929, a result partly due to financial reasons, and partly to the increasing production of budwood from estates' multiplication nurseries.

The total area of budded rubber in the Straits Settlements and Federated Malay States at the present time is estimated to be 73,500 acres. It is known that large areas in Kedah and Johore have been budgrafted: figures will be published later. Several new clones of great promise have also been discovered and records of them are now being kept by the Rubber Research Institute.

Records of high yielding mother trees on a number of estates have been continued and buddings of some of them have already been made at the Rubber Research Institute Experiment Station. It is anticipated that a number of valuable Malayan clones will be derived from these trees.

Numerous enquiries dealing with the technique of budding have been received by the Rubber Research Institute and dealt with, while advice is being freely sought by and given to estates on the suitability of the best known clones and their establishment either as pure clones in blocks or as mixed plantings.

Many estates are also now prepared to plant blocks of single clones which have a sufficiently long record of tapping and which have not developed any defects.

In view of the fact that most planters are now convinced of the value of budding, interest has also been taken in the high budding of 2½ to 4-year old stock and small areas have been budded at 18 inches and higher.

Interest in questions of soil management and systems of soil conservation has continued to extend; present practice on the whole favours silt pitting and bunding combined with clean weeding as the most satisfactory system, as against the establishment of cover crops and the question has been raised as to whether the establishment of heavy covers does not tend to diminish latex yields. The question is under investigation.

Interest in manuring has also tended to expand. The successful results obtained in Sumatra in raising latex yields by manuring have stimulated activity in this direction, and many estates have now embarked upon experimental programmes of manuring. It is now generally recognised that the problem of manuring rubber is a specialised one differing from that of the majority of other crops, inasmuch as the amount of plant food removed by the crop is practically negligible, and manuring is required rather as a stimulant to growth and as a means of replacing losses which have occurred in the past owing to defective soil management than as a consequence of continued cropping.

Continued investigation has shown the value of applying nitrogenous fertilisers on a number of estates, while on others evidence has accumulated which indicates that response to potash fertilisers is obtained.

An important fact to bear in mind is that in the first instance, attention should be paid to medium yielding areas and areas which show initial signs of deterioration. Some very bad areas cannot be treated economically, while on some estates, increased yields due to manuring will be delayed till the vegetative characters of the trees—especially foliage and bark renewal—have been improved.

In view of the availability of high yielding planting material, interest is being taken in rejuvenation and replanting of old rubber areas, which show signs of marked decrease in yield or on which root disease is becoming the limiting factor in the life of the trees or the yield of latex.

Investigations in relation to estate factory practice have demonstrated the possibility of increasing the output of sheet rubber by the use of wide roll light machines and deep coagulating tanks.

On several estates an output equivalent to 1,200-1,300 lbs. of dry rubber per hour has been obtained with a light battery of three smooth roll and one marking machine compared with an average output of 400-500 lbs. per hour obtained in the best factories.

The handling of the coagulum from the coagulating tanks without preliminary hand rolling has been effected by means of suitable aluminium chutes.

An investigation of latex has resulted in the isolation of a lipin body which appears not only to be of importance in relation to rate of vulcanisation but to be closely related to the important variability in plasticity of plantation rubber.

Investigations on the presence of fine sand in latex and sheet rubber have demonstrated the importance of preliminary settling of latex and careful straining in "box" or similar strainers with vertical sieves.

A feature of the year has been the large number of enquiries for advice and assistance received by the Rubber Research Institute in respect of various defects in raw rubber.

Small Holdings.

Increasing interest has continued to centre on the production of rubber from small holdings. Data collected by the Statistical Division of the Department of Agriculture place the production on small holdings for the two years 1929—1930 at the following figures :

	1929.	1930.
Federated Malay States ...	110,282 tons	... 110,206 tons
Straits Settlements ...	—	... 38,770 „ approx.
Unfederated Malay States ...	—	... 66,113 „

It will thus be seen that the production from small holdings as yet shows no signs of diminishing. Considerable attention has been given to the question of bark consumption on small holdings and proposals put forward for under-

taking a regular survey in this respect. Preliminary observations conducted during the year appear to indicate that in the effort to obtain as large a yield as possible the rate of consumption on small holdings may be considerably outstripping the rate of bark renewal.

There is no question that many small holdings have been severely tapped, while the general upkeep has to some extent detriorated. In places a certain number of the poorer holdings have remained untapped for a number of months; on others tapping has only been discontinued temporarily during adverse weather conditions, during padi planting or harvesting operations, or during a period when the price of rubber was at its lowest.

Some owners of small holdings have dismissed their tappers and undertaken the work themselves. Many more have re-introduced the pernicious produce sharing system whereby the tapper receives as pay the larger share of the rubber obtained and, in consequence, extracts every ounce he can, regardless of damage to the trees. Where wages have been paid the rate given has perforce been the lowest possible.

Pests and Diseases of the Rubber Tree.

The most notable feature of the year was a severe outbreak of mildew disease of the leaf caused by the fungus *Oidium Heveae* in certain areas in south Negri Sembilan and Malacca.

This is attributed to the prolonged drought after the normal dry period during the wintering season in February-March. The trees, however, made a good recovery after the secondary leaf fall, which followed the normal leaf fall during February-March.

The fungus was identified in a number of districts later in the year and steps have been taken to deal with the situation if an outbreak occurs during 1931. An important observation is the fact that the fungus appears to be carried over from one season to another on the inflorescences of the tree.

As a result of the outbreak and the investigations conducted, the disease has been declared a Notifiable Disease under the Pests and Diseases Enactment and Ordinance in the Federated Malay States and Straits Settlements respectively.

Two sulphur dusters have also been purchased by the Rubber Research Institute for experimental work while close touch is being maintained with the control work being carried out in Java and Ceylon where the disease has been epidemic in character.

Although it is thought that the climatic conditions generally in Malaya are unfavourable to the outbreak and spread of this disease, this cannot be definitely stated at present, since the trees may become less immune to attacks.

An investigation of the incidence of root diseases—especially *Fomes pseudoferreus* and *Ustulina zonata* in rubber of different age classes—has been continued.

The importance of these diseases to the life of rubber estates is being realised on estates and control measures are becoming increasingly practised.

Somewhat severe outbreaks of Mouldy Rot occurred especially on small holdings during the wet season at the end of the year; measures to deal with this were undertaken.

Arrangements are being made for the investigation of proprietary and other fungicides for the treatment of this disease, since it has been realised that the present position is not altogether satisfactory.

No other fungus diseases call for special comment.

Damage by squirrels has been particularly noted on a few estates, not only on branches but also on the soft renewing bark on the tapping panel.

Scale insects (*Lecanium* species and *Pulvinaria* species) have also caused damage on two estates, chiefly owing to non-attention in the early stages.

An investigation carried out by the Pathological Division of the Rubber Research Institute has demonstrated the value of an asphalt cum kerosene or solar oil mixture as a wound cover or for application on pruned surfaces in budding and other operations.

Research Facilities.

Research work in relation to the rubber industry was continued by the Rubber Research Institute, the activities of which have been maintained at the full strength in spite of slump conditions. Appreciation of the work of the Institute is widespread in planting circles. Close liaison has been maintained by the Institute with the Department of Agriculture and the Department of Co-operation, the former covering all disease control work and propaganda among small holdings and the latter undertaking work in relation to improvement of manufacturing and marketing methods among small-holders.

Miscellaneous Article.

CONDITIONS ON SMALL RUBBER HOLDINGS IN MALAYA.

Third Quarter, 1931.

The Weather.—Rainfall was generally above normal for July but below normal for August and September, except that Malacca experienced wet weather throughout the quarter and parts of Selangor and the Negri Sembilan during September.

Prices.—The following tabulated summary indicates the prices paid to the small-holders by local dealers as compared with both the average Singapore price for the month for standard sheet and the price quoted in Singapore and Penang by large dealers for small-holders' rubber at the end of the month. All quotations are given in Straits dollars and cents at the price per pikul (133⅓ lbs.) for ease of comparison.

	Singapore Standard sheet (Average)	Singapore for small holders rubber	Penang for small holders rubber	Kedah	Province Wellesley	Perak	Selangor	Negri Sembilan	Malacca	Pahang	Johore
					JULY						
Smoked sheet.	12.93	9.50	11.00	10.60-11	10-14	9-12.50	9-14	8-13	8-10.50	8.50-12.50	9-12.50
Unsmoked.		8.50	9.00	8-10.50	9-13	7-10.50	7-9.50	7-10.50	7-8	7-11.50	7-11
					AUGUST						
Smoked sheet.	9.73	7.50	9.00	8-9	8-12	7-10	5-10.50	6-9	7.50-9	7.25-11	6.40-10.5
Unsmoked.		6.00	7.00	-	6-11	6-7.50	5-7	5-8	6-7	6-9.20	6-9.25
					SEPTEMBER						
Smoked sheet.	10.13	8.50	9.00	6-8.30	8-11.60	7.50-11.50	6-11	6-10	8-9	7-9	6-11
Unsmoked.		7.00	7-7.50	4-6.50	7.50-9.25	6-8	5-7.50	5-8	6-7	5-8	6-10

In comparing the above figures it must be realised that the quotation for Singapore standard sheet is the average price for the month, whereas other quotations give the range of prices during the month and, except in the case of quotations for Singapore and Penang, the range of prices over a number of buying centres. In some such centres the price is regularly maintained at a higher level than at others. Thus, in Province Wellesley for September the range of prices in dollars per pikul for smoked sheet at four centres was,

Butterworth $8.40 to $11.60; Bukit Mertajam $10; Sungei Bakap $8 to $10; Dindings $8 to $9. The Butterworth price is always relatively high owing to a supply of comparatively high grade rubber, competition of buyers and nearness to Penang. Similarly, the Perak prices for September at ten centres were, Taiping $11.50; Krian $7.50; Batu Kurau $9.50; Selama $7.50 to $9; Kuala Kangsar $9 to $10; Tapah $7.50 to $8.50; Kinta $8 to $8.50; Tanjong Malim $9.25; Telok Anson $9.20 and Bagan Datoh $8.50.

It will be seen that the prices paid in many centres are higher than Penang and Singapore quotations for small-holders' rubber. In some instances, the higher prices quoted for small buying centres approximate closely to the highest quotation for Singapore Standard Sheet during the month. Recent investigations regarding prices indicate that the price paid by the local buyers in some centres for small-holders' rubber leaves little margin for profit if the product is to be sorted and re-sold as sheet in various grades at the prices quoted for those grades. At the moment there appears to be a better market for native rubber for re-milling than for re-sale as sheet after grading. A large proportion of the re-milled rubber is turned into blanket crepe for which there appears to be an increasing demand, and the miller appears to rely for his profit upon a large turnover rather than upon any great difference between the buying and selling price.

Tapping.—Reports of the cessation of tapping on further holdings have been received during the quarter. Thus, in the Negri Sembilan, the acreage of untapped holdings was estimated to total 5,000 acres in July, 5,700 acres in August and 6,000 acres at the end of September. In the case of holdings owned by Chinese and Chettiars the continued low price of the commodity is the cause and such holdings are likely to remain untapped indefinitely unless the price rises. With regard to Malay-owned lands, the stoppage is in most cases probably only temporary whilst owners are engaged on padi planting. In Malacca, where padi planting is practically completed, tapping on many holdings was reported to have re-commenced in September.

Reports are general from throughout Malaya of increasing numbers of cases of excessive tapping and bark removal where owners' only source of livelihood is rubber.

Judging from the returns so far to hand in connection with the bark consumption investigations, three inches is a usual width of bark removal during the course of a month, although cases of two inches occur as well as several cases of four and five inches and a few of six inches. There is considerable variation in length of the tapping cut in relation to tree circumference. Returns examined are not sufficiently numerous to provide more than an indication, so the figures given may need to be modified to some extent when more returns are available and they have received more critical examination than has yet been accorded.

Planting Distances.—Judging again from returns connected with the investigations mentioned, the most common planting distances would appear to be

12 feet by 12 feet and 15 feet by 15 feet. Limits so far recorded are 10 feet by 10 feet as the nearest and 20 feet by 20 feet as the widest distance. Here also further data may show that modification of figures will be necessary.

Grade of Rubber made.—For some time past there has been a tendency for the small-holder in many centres to neglect the manufacture of sheet rubber in favour of an article that requires much less preparation. This slab or lump rubber is crudely prepared and, on present accepted standards, is a low grade product. Compared with sheet it is imperfectly dried. In the Krian and Larut Districts of Perak its price per pikul was from $6 to $7 in July, $3 to $5 in August and $4 to $5.50 in September. At this price for an article of comparative high moisture content that demands little time or care in its preparation, the sale of slab or lump rubber is possibly a better economic proposition for many small-holders than the preparation of the higher priced sheet rubber. The demand for slab or lump rubber is connected, most probably, with the increased demand for rubber for re-milling into blanket crepe.

Diseases.—(a) *Mouldy Rot.* During the quarter it has become increasingly evident that the present economic position of the small-holder has made it impossible for the Department of Agricuture to insist upon the former standard of control of Mouldy Rot. Standard methods included cessation of tapping for a period of from three weeks to one month, whilst the recently tapped area was painted with an approved fungicide at ten-days intervals. Where an owner relies solely upon rubber for his livelihood it is often impossible to enforce the period of stoppage. Furthermore, many small-holders have not the money to buy sufficient quantities of the necessary fungicides to effect efficient control. Consequently, where these conditions obtain, efforts are directed towards minimising the damage to renewing bark by encouraging periodic painting with an approved fungicide.

(b) *Root Disease.* General observation of small holdings in Malaya inclines to the opinion that root diseases are less common and do much less damage on small holdings than on estate rubber and this opinion receives support from observations made by the Bark Recorder in charge of the bark consumption investigations. He reports that of the trees chosen for records in the selected holdings he has so far examined, there is a surprising sparsity of noticeable evidence of root diseases.

In only a very few cases has he noticed trees with visible signs of such diseases. As the method employed in these investigations is to mark off 100 consecutive trees in each of the holdings selected, his report indicates that root disease is probably a factor of little importance in small-holders' rubber. The Bark Recorder has had much practical experience on estates so his opinion is worthy of some attention. At the same time, his opinion is formed from above-ground observations only and not from detailed examination of the roots of trees on small holdings. A tree to tree inspection for root disease is the only method of obtaining exact information on the matter and this is a very expensive operation, so is impracticable of performance on a large scale.

Departmental.

FROM THE DISTRICTS.

The Weather.

Normal wet October weather obtained in Kedah and Province Wellesley. In Perak generally, although the month was fairly uniformly wet, the rainfall was below the October average, especially in the south of the State. Selangor's weather was showery and towards the end of the month very heavy showers fell in some inland localities, but rainfall throughout the State was below normal for the month. In Negri Sembilan and Malacca the weather was appreciably drier than for September and the same applies to West Pahang. On the east coast of Pahang cloudy weather with occasional showers was experienced.

Remarks on Crops.

Rubber.—The prices paid for small-holders' rubber by local dealers in dollars and cents per pikul* ranged as follows during the month; smoked sheet, $7.50 to $13.00; unsmoked sheet, $6.50 to $11.00; scrap, $2.00 to $6.00; lump, $3.00 to $7.00. The range quoted in Penang for small-holders' smoked sheet was $9.00 to $12.00 whilst the average price for the month for Singapore standard sheet was $11.75.

It will be noted that prices have ruled appreciably higher than for September and that the highest price paid in local centres for small-holders' smoked sheet is higher than the average price quoted for Singapore standard sheet. The reason appears to be that for a short period some speculative buying took place in certain centres on rumours of lower freight charges and that some form of restriction was to be introduced.

The area of untapped holdings in Negri Sembilan is reported to have increased to approximately 7,000 acres at the end of the month. On the other hand it is reported from Province Wellesley and Malacca that the increase in price resulted in the re-opening of a number of holdings that had been out of tapping for some time.

Padi.—Planting operations are now completed throughout Kedah, Province Wellesley, Perak, Negri Sembilan and Malacca, except for the Sungei Acheh area and in portions of the Central and South districts of Province Wellesley and parts of the Larut District of Perak. Exceptionally high tides caused considerable damage to the crop in certain coastal areas. Thus, in Kuala Kurau mukim of Krian, the inundation of sea water damaged approximately 30 acres of planted padi whilst in the Dindings and in Sabak sub-district of Selangor, practically all the plants in nurseries were destroyed. As the Sabak cultivators were without any supply of seed padi to re-sow their nurseries, 3,000 gantangs of seed of short season strains were supplied for the purpose from stocks held by the Department of Agriculture. A discolouration of leaves of padi in parts

* 1 picul = 133⅓ lbs.

of the Krian District was reported at the end of the month and the matter is under investigation. Apart from these occurrences, the crop is generally reported to be making satisfactory growth throughout the country.

Tobacco.—Continued interest is evinced in this crop. In Province Wellesley the area under tobacco is approximately 80 acres and in South Perak, 250 acres. Increased plantings are reported from Negri Sembilan, Selangor and Pahang. Some small-holders have planted up small areas of the Kedah type in the vicinity of Jerantut in Pahang. As expected would be the case on this volcanic soil, growth is reported to be exceptionally good. From specimens of diseased plants received for examination it would seem that the organism which causes Slime Disease, *Bacillus solanaccarum,* is widely distributed in Malaya. During the month, the sale in Penang of cured Province Wellesley grown leaf amounted to approximately 120 pikuls. The price paid per pikul ranged from $15.00 to $35.00 according to quality. Prices in Perak South for locally grown and cured leaf ranged from $40.00 to $60.00 a pikul.

Agricultural Stations and Padi Test Plots.

Kedah.—The work of fencing and levelling proceeded satisfactorily at the Agricultural Station at Gajah Mati. The crop at the main rice station at Telok Chengai and at the Jitra Test Plot made satisfactory growth, whilst slower growth is reported on the poorer soil at Langgar Test Plot. Transplanting of the Rantau Panjang Test Plot was completed. At the Jitra and Langgar plots the fresh water crab (*Paratelphusa sexpunctata*) did some damage, necessitating control measures by means of baited earthenware pots, fish traps and bamboo joints. At Jitra the case worm, *Nymphula depunctalis,* put in an appearance.

Province Wellesley.—At Glugor Padi Test Station further plantings of six short season varieties were made. Three further very short season strains remain to be planted to complete the programme. At Bukit Merah the planting programme was completed. Drainage conditions at Glugor are considerably improved as the result of the recently erected additional culvert under the main road.

Perak. (*a*) *Agricultural Stations. Selama.*—Further progress has been made with clearing and levelling and in preparing foundations for the road and paths. Preliminary arrangements for fencing and buildings were completed.

Kuala Kangsar.—Seed of the Virginian tobacco, Joyner, is being collected and fresh nurseries of this crop have been sown. Green dressing crops have made a good start. A crop of groundnuts was harvested but gave a poor return. Coffee nurseries were laid down.

(*b*) *Padi Stations and Plots. Talang Station.*—Planting was completed and growth on the earlier planted areas is satisfactory. On the manurial experimental plots the plants that were manured in the nurseries have a decidedly much deeper green leaf than those differently treated. The banana area is being prepared for planting and suckers of the variety Embun have been ordered from Negri Sembilan.

Lenggong.—The earlier planted Seraup strains are making good growth and tillering freely. Trouble is still being experienced on certain deep portions of the station and much supplying is necessitated on such parts.

Bruas.—Growth is satisfactory, but differences in water levels are proving troublesome.

Bukit Gantang.—Planting commenced on the 10th. and was completed on the 21st. Water was scarce early in the month.

Kamunting.—Planting of the portion used for nurseries completed the planting programme. Water shortage caused some difficulty early in the month, but there was an adequate supply at the end of the month. The case worm, *Nymphula depunctalis* and the pentatomid bug, *Scotinophora coarctata*, (locally called Kutu Bruang or Bena Kura) caused some damage, which necessitated control measures. The manured strips stand out noticeably, both as regards deeper colour and increased vigour.

Selinsing.—Good growth was maintained, notwithstanding scarcity of water. A marked increase in growth and development is apparent in the manured plots.

Selangor. Cheras Agricultural Station.—Further progress was made with preliminary cultivation, lalang grass eradication and fence erection. The completion of two boundary drains on the north and south has resulted in much better drainage of the lower portions of the area. Work has commenced on the main access road and a contract for buildings has been made.

Kajang Test Plot.—The short season strain F.S.27 is ripening a good crop, but the two Radin varieties have not yet flowered.

Kuang Test Plot.—Here again the short season strains F.S. 27 and Radin Siak have come into bearing before the longer season Siam and Radin types. The pianggang, *Leptocorisa arcuta,* which damages the unripened grain, gave much trouble to the earliest ripening strains.

Negri Sembilan. Agricultural Stations. Seremban.—Pepper received a mulch and manure and shoots were layered to increase the stock. Sowings were made of maize and cloves.

Rembau.—All buildings are now roofed. Fencing has not progressed as rapidly as was anticipated. Work on roads was commenced and paths were planted with Carpet Grass.

Rembau Padi Test Plot.—Growth has been delayed by excess water due to heavy local rain. In the portion near the main road plants exhibit better growth than elsewhere on the plot.

Malacca. (a) Agricultural Stations. Sungei Udang.—Planting of rubber (Clone S.R. 9), Brazil nut, avocado pear, mangosteen, rambutan and lime took place, whilst pineapples, pepper and budded kapok are being planted. Materials for buildings have been collected on the land preparatory to erection.

Jasin.—Survey of the site is in hand.

(*b*) *Padi Stations and Test Plots. Pulau Gadong.*—Nurseries of two Australian and four Italian short term varieties were sown. Weeding was in progress. His Excellency the Governor visited the station on the 22nd.

Alor Gajah.—The appearance of this Test Plot is excellent. The varieties Siam 29 and Nachin 10 have commenced to flower.

Pahang. (*a*) *Agricultural Stations.*—One plot of sweet potatoes was harvested and another two plots have been planted. Maize, groundnuts, soya beans and tobacco are making good growth.

Temerloh.—Felling, clearing and preliminary cultivation was completed Fencing posts have been erected and erection of buildings commenced.

Kuantan.—Erection of buildings was commenced.

Pekan.—Repair work on the cattle shed was completed and gates and signboards were erected. The dry land padi is making fair growth but weeds are very troublesome, necessitating frequent weeding.

(*b*) *Padi Test Plots. Dong.*—Planting was completed. Growth is vigorous and tillering exceptionally good. Work on a new store was commenced.

Temerloh.—Harvesting commenced with the strain F.S. 27 and the other varieties are flowering. The plants are somewhat uneven due, doubtless, to variation in depth of water.

Pekan.—F.S. 27 and Radin Siak have commenced to flower, but the crop is expected to be light owing to dry weather and consequent lack of water for the past month.

Singapore. Pineapple Station.—General routine work on the pineapples continued, such as weeding and labelling. The growth, though even, is very slow compared with plants on virgin land. The green dressing plants have shown some response to chemical manures and farmyard manures but no response to lime. The principal interest during the month centred around the Virginian tobacco trials. Further nurseries of the variety Hickory Prior were sown.

DEPARTMENTAL NOTES.

H. E. The Governor visits Malacca.

H. E. The Governor, accompanied by the Resident Councillor, Malacca, visited the Pulau Gadong Rice Experiment Station on 22nd October, 1931.

The Acting Director of Agriculture visits Perak.

The Acting Director of Agriculture (Mr. F. W. South) paid a visit of inspection to Agricultural Stations and Padi Test Plots in Perak from the 13th. to the 19th. October, 1931.

Copra Kilns.

Mr. F. C. Cooke, Assistant Chemist for Copra Research, visited Province Wellesley to advise a coconut estate on questions connected with the designing and working of Ceylon-type copra kilns.

Tobacco Cultivation.

Increasing interest has recently been shewn by Asiatics in the cultivation of tobacco, the stimulus probably being provided by the increase in duty on imported tobacco and the need felt of growing any crop which is likely to give an early cash return.

The market for the indifferent quality of leaf usually produced, however, is limited and there is evidence that prices will not long remain at their present high level.

An article on tobacco cultivation which has recently been published in the Vernacular journals of this Department was opportune, as a number of letters of enquiry from both Malay and Chinese for information on this crop have been received.

Tuba Root.

The Agricultural Chemist is engaged in the determination of the rotenone content of tuba root of various species. The results of this work will not be available for some time.

An investigation has also been commenced to ascertain the extent to which the ether extract of the root is affected by reason of insect attack on the stored tuba root.

Rural Lecture Caravan.

The tour in Perak North arranged for between September 1st. and 19th could not be carried out wholly according to schedule as a breakdown to both dynamos unfortunately occurred at Lenggong on the 9th. The caravan was immediately despatched to Ipoh for repairs, but the incident necessitated

abandoning four of the centres arranged upon in the programme. Altogether fourteen instead of eighteen centres were visited. A performance was given before H. H. the Sultan of Perak at Kuala Kangsar on September 6th.

A further tour of the Lower Perak District was arranged for the period October 2nd. to 9th. inclusive. Here again dynamo trouble was experienced which necessitated giving up visits to three centres in the Bagan Datoh area. This was particularly unfortunate as a special lecture with exhibits had been prepared for this area for propaganda connected with coconuts and copra production. Since the return of the caravan to headquarters, a thorough overhaul of the engine and electric installation has been made and it has been decided to provide a separate self-contained generating plant that can be transported in the caravan, but which is sufficiently light to be capable of being carried for short distances by two or three men. It is expected that this will not only make for greater mechanical efficiency, but will also enable places to be reached some distance from a main road that cannot be served by the caravan itself. It should also make it possible to arrange tours by launch and so reach the population living on the banks of the larger rivers.

Leave.

Mr. J. N. Milsum, Assistant Agriculturist, has been granted 8 months and 16 days' leave on full pay with effect from the 3rd. October, 1931.

Mr. F. S. Banfield, Horticultural Assistant, returned from leave of absence on 15th. October, 1931.

Mr. A. Thompson, Acting Mycologist, returned from leave of absence on 29th. October, 1931.

Statistical.

MARKET PRICES.

October, 1931.

Rubber.—The average spot price of rubber smoked sheet equal to London standard in Singapore was 8.8 cents per lb. in October, as compared with an average of 7.6 cents in September. The highest price was 9¾ cents and the lowest 8 cents. The London average price was 2.9d per lb., as compared with 2.5d in September.

Palm Oil.—London states that, in common with most commodities, palm oil advanced in price on the change of the basis of sterling and up to £18.10.0 was paid for Malayan oil. Prices, however, have declined and the recent rise in price has been of little use to producers generally.

Copra.—The local price of copra has decidedly firmed during the month, the average Singapore price of Sundried being $4.95 per picul, with Mixed 49 cents lower. Average prices for September were: Sundried $4.04, Mixed $3.72 per picul. Copra cake has been steady at $2 per picul.

Coconut Oil.—Our Singapore correspondent states that the market for coconut oil has steadied slightly during October. Business was well established for the first half of the month, but afterwards was dull. The average wholesale export price for October was $9.50 per picul.

Gambier.—Block gambier has been steady at $12 per picul, while Cube No. 1 has advanced from $19.00 to $20.50 per picul, the average price for October being $19.90, compared to $17 in September.

Rice.—The average declared trade value of rice into Malaya during September was $4.15 per picul, as compared with $4.04 in August. The retail market prices in cents per gantang of No. 2 Siam rice in September were:—Singapore 31, Penang 32, Malacca 29, compared with 30, 31 and 28 cents respectively in August.

Arecanuts.—Average prices of Palambang were around the previous month's level, the average price for October being $4.55 per picul. Bila Whole improved slightly in price from the average of $4.16 per picul in September to $4.25 in October. For other grades, the average prices in October were as follows:—Sliced, $8.95 to $12.50; Split, $4.75 to $6.41; Red Whole $8.88 to $9.30—all per picul, the price within each range depending upon quality. Kelantan Split averaged $6.25, but being the end of the season, the import crop was very small and the quality inferior. Split and Whole arecanuts were in better demand for the Indian market at the end of the month.

Coffee.—Java Robusta prices have remained steady, the average for the month being $15.10 to $17 per picul, the price between these limits depending upon quality. Corresponding average prices for September were $15.31 to $16.44. The average price for Palambang coffee in October was $12.65 as compared with $11.69 in September.

Pineapples.—Prices have remained steady during the month. The canning season is now in full swing, but the demand appears to be moderate, buyers probably holding off for lower prices. The average prices in October were :—1½ lb. cubes, $3.72; 1½ lb. Sliced flat, $3.43; Sliced tall, $3.40 (nominal) all per case. Corresponding prices in September were :—$3.50, $3.27, $3.31.

Tapioca.—Prices have been steady around the following average prices for October. Flake, fair, $3.60; Pearl, seed, $4.75; Pearl, medium, $5.00 per picul. Corresponding average prices in September were :—$3.41, $4.47 and $4.49.

Sago.—A fluctuating market with sellers inclined to hold out for fancy prices. Average Singapore prices in October were :—Pearl, small, fair, $4.78; Flour, Sarawak, fair, $2.36 per picul. Corresponding prices in September were $4.44 and $1.82 per picul.

Nutmegs and Mace.—Both quoted at nominal figures, the market being dull with but little demand. Average October prices in Singapore were :—Mace, Siouw $70 and Amboina $46.40 per picul. Nutmegs, 110 per lb., $23.90 per picul; 80 per lb., $35 per picul.

Pepper.—The market has shewn much fluctuation on account of varying demand and heavy arrivals. Average Singapore prices per picul in October were :—Singapore, Black, $19.90, Singapore White, $30.40; Muntok White, $31.40. Corresponding prices in September were $19.09, $28.56 and $29.44.

Cloves.—Nominal prices in Singapore have been quoted throughout the month. Average prices for the month were :—Zanzibar $45 per picul; Amboina $53.40 per picul, as compared with $50 and $60 for September.

The above prices are based on London and Singapore quotations for rubber; on the Singapore Chamber of Commerce Reports published in October and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Lewis and Peat (Singapore) Ltd.; reports on the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore, and a report on the coconut oil market by the Ho Hong Oil Mills, Singapore.

1 picul = 133⅓ lbs. The dollar is fixed at two shillings and four pence.

NOTE. The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY.*

September, 1931.

Malaya.—Total foreign imports of rice into Malaya for September, 1931 amounted to 56,856 tons, of which 50.9 per cent. were into Singapore, 19.4 per cent. into Penang, 5.1 per cent. into Malacca, 17.5 per cent. into the Federated Malay States and 7.1 per cent. into the Unfederated Malay States.

Of these imports, 53 per cent. were from Siam, 42 per cent. from Burma, 4 per cent. from French Indo-China and 1 per cent. from other countries.

The total foreign imports of rice into Malaya from January to September 1931, were 531,896 tons, net imports being 406,695 tons, or 41,771 tons less than for the corresponding period of 1930.

The total foreign exports of rice in September 1391 were 11,739 tons.

Stocks of padi and rice held by wholesale dealers and millers in the Straits Settlements and Federated Malay States at the end of August amounted to padi 8,744 tons and rice 43,066 tons.

It is estimated that the stocks of rice (converting padi at 62 per cent.) in the Federated Malay States, Straits Settlemens and Johore at the end of August amounted to 65,109 tons, as compared with 51,532 tons at the end of July.

Padi reports indicate that work for the new season 1931—2 is in hand in all padi areas.

India.—Total foreign exports of milled rice during January to August 1931, were 1,556,000 tons, a decrease of 569,000 tons or 26.7 per cent. as compared with the corresponding period of 1930, and a decrease of 231,000 tons or 12.9 per cent. as compared with the corresponding period of the past six years.

Burma exports of rice and rice products (including exports to India) from January 1 to September 19, 1931, were 2,884,387 tons, an increase of 7,838 tons over the same period of 1930.

Japan.—Stocks of rice in Japan (Proper) on September 1, 1931, were 2,456,780 tons, a decrease of 1,209,703, or 33 per cent. as compared with the stocks on July 1, 1931.

It is reported that good weather in August has enabled plants to recover the losses in July and that the rice crop for the current season will be normal.

Formosa. It is reported that the first rice crop of 1931 yielded 508,876 tons for the 677,444 acres planted. This represents an increase of 20,449 tons over the record 1930 figures for the same crop. This satisfactory result was due to exceptionally favourable weather conditions, the increase of 17,284 acres in area planted and to increased marketing facilities in Japan for Formosan rice.

*The following is an abstract of the General Rice Summary for September, 1931 compiled from various sources by the Registrar-General of Statistics, Straits Settlements.

Siam.—Exports of rice from Bangkok from December 1930 to August 1931 were 919,514 tons, an increase of 86,078 tons or 10.3 per cent. as compared with the same period of the previous year and a decrease of 130,113 tons, or 12.4 per cent. as compared with the average of the same period of the last five years.

The area under padi in the seven exporting circles at the end of July 1931, was 2,171,672 acres, as compared with 2,771,652 acres at the same period of the previous year, or a decrease of 21.6 per cent.

The area under padi for the season 1930—31 in Siam (whole Kingdom) was 7,950,208 acres, an increase of 4.7 per cent. and the yield was 4,787,998 tons, an increase of 24.6 per cent. as compared with the previous season (1929—30).

Java, Madura and Netherlands East Indies.—At the end of August 1931, the area harvested amounted to 7,825,338 acres, a decrease of 1.7 per cent. as compared with the same period of 1930; the area damaged to 392,322 acres, an increase of 90.4 per cent. over the previous season; and the area standing to 974,617 acres, an increase of 1.5 per cent. as compared with the same period of 1930.

Imports into Java and Madura, January to August 1931, were 195,163 tons, compared with 204,468 for the same period of 1930. Imports into the Outer Provinces, January to July, 1931, were 197,422 tons as compared with 191,354 tons for the same period of 1930.

French Indo-China.—Entries of padi at the port of Cholon (January to September 30, 1931) were 893,164 metric tons, a decrease of 122,469 metric tons or 12.1 per cent. over the same period of the previous year.

Exports of rice from Saigon (January to September 30, 1931) were 786,533 metric tons, a decrease of 127,407 metric tons, or 13.9 per cent. as compared with the same period of the previous year.

Ceylon.—Imports January to August, 1931, inclusive were 293,374 tons, a decrease of 22,413 tons or 7.1 per cent. as compared with the same period of the previous year.

Of the total imports in 1931, 16.8 per cent. were from British India, 75 per cent. from Burma, 2 per cent. from the Straits Settlements and 8 per cent. from Cochin-China and Siam.

Europe.—For the period January 1st to September 17, 1931, 883,913 tons of rice were shipped, compared with 604,366 tons for the same period of 1930 or an increase of 46.3 per cent.

Of the total shipments, 63.9 per cent. were from Rangoon, 24.8 per cent. from Saigon, 5.9 per cent. from Siam, 2.7 per cent. from Japan and 2.7 per cent. from Bengal.

To the Levant, period January 1st to August 19, 1931, 45,890 tons were shipped, an increase of 30,452 tons or 198.4 per cent. as compared with the same period of 1930.

To the West Indies and America, period January 1st to August 13, 1931, were shipped 113,069 tons, a decrease of 23.5 per cent. as compared with the same period of the previous year.

MALAYAN AGRICULTURAL EXPORTS.

August, 1931.

Product	Net Export in Tons.				
	1930	Jan. 1—July 31, 1930	Jan. 1—July 31, 1931	August 1930	August 1931
Coconut, fresh ...	10,475	6,051	4,721	807	605
Copra ...	102,014	46,530	47,042	10,029	13,732
Coconut oil ...	9,475	5,668	5,939	651	701
Palm Oil ...	3,211	1,594	2,033	149	281
Palm Kernels ...	485	235	301	31	23
Pineapple, canned ...	57,698	39,423	41,029	5,305	4,305
Tapioca ...	31,195	17,944	17,272	3,176	2,516
Arecanuts ...	23,254	15,386	12,595	1,901	454
Tuba Roots ...	55½	—	41	—	~~106~~

AREA OF MATURE RUBBER UNTAPPED IN JULY AND AUGUST IN JOHORE AND KEDAH.

(Estates of 100 acres and over)

State.	Area Untapped (Acres)					
	Estates which have entirely ceased tapping.		Estates which have partly ceased tapping.		Total area untapped (b)	
	July	August	July	August	July	August
Johore ...	23,464 (a)	23,445	49,583 (a)	49,164	73,047 (a)	72,609
Kedah ...	4,158		9,196		13,354	

(*a*) Rubber land owned by Registered Companies only. Reports from Kedah are received quarterly only. The Kedah figures given above are those reported at the end of June.

(*b*) Areas rested due to rotational tapping system are not included in the above table. The figures of areas untapped owing to rotational tapping system were for Kedah at the end of June 9,072 acres; Johore, end of July 30,161 and end of August 31,182 acres.

RUBBER AREAS UNTAPPED IN AUGUST AND SEPTEMBER 1931 IN THE FEDERATED MALAY STATES AND STRAITS SETTLEMENTS.

(Estates of 100 acres and over)

State or Territory.	AREA UNTAPPED (ACRES)				Total area untapped *	
	Estates which have entirely ceased tapping.		Estates which have partly ceased tapping.			
	August	September	August	September	August	September
Perak ...	8,264	8,483	28,178	28,532	36,442	37,015
Selangor ...	13,219	13,382	41,594	40,372	54,813	53,754
Negri Sembilan ...	15,906	15,051	22,573	23,551	38,479	38,602
Pahang ...	6,370	6,323	4,811	5,000	11,181	11,323
Total F.M.S. ...	43,759	43,239	97,156	97,455	140,915	140,694
Province Wellesley ...	3,056	3,166	7,723	7,720	10,779	10,886
Dindings ...	237	237	1,694	1,701	1,931	1,938
Malacca ...	4,650	4,862	18,549	17,833	23,199	22,695
Penang Island ...	747	747	165	150	912	897
Singapore Island ...	9,416	10,004	5,477	5,315	14,893	15,319
Total S.S. ...	18,106	19,016	33,608	32,719	51,714	51,735
Total F.M.S. & S.S. ...	61,865	62,255	130,764	130,174	192,629	192,429

Rubber areas rested due to rotational tapping system were as follows :—

	August	September
F.M.S. ...	37,297	39,650
S.S. ...	12,203	11,666
Total ...	49,500	51,316

* Not including areas untapped owing to rotational tapping system.

MALAYA RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF SEPTEMBER, 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated) 2		Imports				Exports (including re-exports)				Stocks at end of month		
								during the month		during the year 1931		during the month		during the year 1931				
	Ports	Dealers	Estates of 100 acres and over	During the month	during the year 1931	during the month	during the year 1931	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	13,748	14,731	11,995	104,789	9,687	77,445	Nil	Nil	Nil	26	14,649	9,989	118,056	66,259	...	12,035	13,500
Johore	...	2,326	3,977	3,551	31,772	3,151	34,046	Nil	1	Nil	19	906	5,983	7,136	59,428	...	2,356	3,761
Kedah	...	454	2,356	2,244	18,915	1,026	9,337	Nil	Nil	Nil	Nil	577	2,833	5,626	23,005	...	450	2,220
Perlis	...	17	4	4	60	10	91	Nil	Nil	Nil	Nil	Nil	7	Nil	144	...	22	6
Kelantan ...	...	115	189	187	1,575	242	3,345	26	Nil	43	Nil	68	438	612	4,512	...	160	93
Trengganu ...	..	55	50	122	920	61	460	Nil	Nil	Nil	Nil	Nil	183	Nil	1,380	..	55	50
Total Malay States	...	16,751	21,307	18,103	158,031	14,177	124,724	26	1	43	45	16,206	19,433	131,432	154,728	...	15,078	19,630
STRAITS SETTLEMENTS																		
Malacca ...	...	3,119	1,561	1,375	11,197	(2)	(2)	Nil	19,471	Nil	155101	3,922	Nil	39,688	Nil	...	2,955	1,480
Province Wellesley	...	142	558	499	4,144			Nil		Nil						...	122	512
Dindings ...	...	114	141	97	857	2,416	18,316	Nil		Nil		5,856		54,439		...	93	125
Penang	730	4,822	8	7	67			215		5,379						1,824	2,927	7
Singapore ...	4,887	34,196	280	159	1,592			6,614		71,727		18,358		164,367		5,833	32,314	282
Total Straits Settlements	5,617	42,393	2,548	2,137	17,857	2,416	18,316	6,829	19,47	77,106	155,101	28,136	Nil	258,494	Nil	7,657	38,411	2,406
TOTAL MALAYA	5,617	59,144	23,855	20,240	175,888	16,593	143,040	6,855	19,472	77,149	155,146	44,336	19,433	389,926	154,728	7,657	53,489	22,036

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	9,589	30,238	2,677	2,952	937	46,393
WET RUBBER	2,446	2,076	250	218	1,419	6,409
TOTAL ...	12,035	32,314	2,927	3,170	2,356	52,802

TABLE III
FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	28,479	253763
Penang ...	9,677	88,994
Port Swettenham.	6,053	43,761
Malacca ...	127	3,408
MALAYA ...	44,336	389926

TABLE IV
THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ...	37,222	312225
Straits Settlements		
MALAYA ...	37,222	312225

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 21st October, 1931.

METEOROLOGICAL SUMMARY, MALAYA, SEPTEMBER 1931.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day	Number of days					Total	Daily Mean	Per cent
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation* .01 in or more	Precipitation, .05 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	89.4	72.0	80.7	95	69	82	75	84.1	84.9	9.68	245.9	1.54	18	17		1		163.15	5.44	
Bukit Jeram, Selangor ...	88.3	72.7	80.5	92	70	81	75	84.4	86.6	6.28	159.5	1.01	20	16				180.15	6.01	50
Sitiawan, Perak ...	89.5	72.7	81.1	93	70	83	75	84.7	85.0	7.88	200.2	1.37	17	13	1	1		180.20	6.01	
Kroh, Perak ...	85.1	69.9	77.5	91	67	79	73	82.3	82.9	4.10	104.1	1.12	22	15		1		158.60	5.29	
Temerloh, Pahang ...	89.4	72.5	80.9	94	70	84	75	84.9	86.3	12.58	319.5	3.95	18	13	5	7		167.20	5.57	
Kuala Lipis, Pahang ...	88.6	71.5	80.1	92	69	81	75	83.6	84.5	11.79	299.5	2.57	17	13	14	21	1	140.80	4.69	
Kuala Pahang, Pahang ...	87.0	74.2	80.6	90	72	84	77	84.6	86.4	6.32	160.5	2.58	14	9	1			178.50	5.95	
Mount Faber, Singapore ...	87.4	74.9	81.1	91	70	80	79	82.9	83.7	9.79	248.7	2.61	21	19	1			160.70	5.36	44
Butterworth, Province Wellesley ...	87.4	74.2	80.8	92	72	84	76	84.9	85.2	5.68	144.3	1.17	21	17			1	179.30	5.98	
Bukit China, Malacca ...	84.8	73.7	79.3	88	71	81	76	83.1	83.9	17.20	436.9	3.51	20	18	7			172.80	5.76	48
Kluang, Johore ...	87.4	71.6	79.5	92	69	80	73	82.4	83.1	9.92	252.0	2.38	19	14	2	6		134.40	4.48	37
Bukit Lalang, Mersing, Johore	88.6	72.0	80.3	92	70	84	74	82.9	83.0	5.63	143.0	0.96	16	13				167.80	5.59	46
Alor Star, Kedah ...	86.6	74.1	80.3	90	70	82	77	86.2	86.5	8.11	206.0	1.48	22	19			1	168.75	5.62	
Kota Bahru, Kelantan ...	89.2	73.6	81.4	92	72	81	75	85.2	85.9	8.18	207.8	1.57	17	16	1	1		189.70	6.32	51
Kuala Trengganu, Trengganu	88.4	72.7	80.5	91	70	85	75	84.8	85.9	8.44	214.4	1.84	18	11	2			189.75	6.33	52
HILL STATIONS.																				
Cameron Highlands, Rhodendron Hill, Pahang 5120 ft. ...	71.2	59.1	65.1	76	56	64	61			8.45	214.6	1.47	21	18		3	1	124.75	4.16	34
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.1	57.2	64.7	78	52	66	62	70.3	70.3	8.77	222.8	2.21	22	18	1	7		113.95	3.80	31
Fraser's Hill, Pahang 4268 ft.	73.9	62.1	68.0	77	59	67	64	71.4	71.9	4.53	115.1	0.68	22	15	5	18		144.80	4.83	40

Compiled from Returns supplied by the Meteorological Branch, Malaya.